GEOGRAPHY, RESOURCES & INDUSTRIES

March, 1945

EDISON ELECTRIC INSTITUTE BULLETIN

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PUBLISHED MONTHLY BY EDISON ELECTRIC INSTITUTE

THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

November, 1943 and 1944

SOURCE AND DISPOSAL OF ENERGY—MONTH OF NOVEMBER

	1944	1943	%
GENERATION* (Net)			
By Fuel Burning Plants	13,461,210,000	13,446,631,000	+ 0.1
By Water Power Plants	5,700,942,000	6,038,348,000	− 5.6
Total Generation	**19,162,152,000**	**19,484,979,000**	**− 1.7**
Add—Net Imports over International Boundaries	122,802,000	112,867,000	+ 8.8
Less—Company Use	140,510,000	138,165,000	+ 1.7
Less—Energy Used by Producer	242,224,000	865,732,000	−72.0
Net Energy for Distribution	**18,902,220,000**	**18,593,949,000**	**+ 1.7**
Losses and Unaccounted for	2,424,969,000	2,104,132,000	+15.2
Sales to Ultimate Consumers	**16,477,251,000**	**16,489,817,000**	**− 0.1**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of November 30th			
Residential or Domestic	27,365,588	26,838,617	+ 2.0
Rural (Distinct Rural Rates)	1,140,560	1,091,099	.....
Commercial or Industrial:			
Small Light and Power	4,260,712	4,162,491	+ 2.4
Large Light and Power	151,952	147,869	
Other Customers	117,729	119,985	.....
Total Ultimate Customers	**33,036,541**	**32,360,061**	**+ 2.1**
KILOWATTHOUR SALES—During month of November			
Residential or Domestic	2,685,291,000	2,474,798,000	+ 8.5
Rural (Distinct Rural Rates)	241,746,000	204,026,000	+18.5
Commercial or Industrial:			
Small Light and Power	2,546,966,000	2,394,838,000	+ 6.4
Large Light and Power	9,315,122,000	9,596,602,000	− 2.9
Street and Highway Lighting	207,276,000	198,967,000	+ 4.2
Other Public Authorities	791,402,000	917,080,000	−13.7
Railways and Railroads:			
Street and Interurban Railways	384,056,000	398,555,000	− 3.6
Electrified Steam Railroads	223,862,000	221,078,000	+ 1.3
Interdepartmental	81,530,000	83,873,000	− 2.8
Total to Ultimate Customers	**16,477,251,000**	**16,489,817,000**	**− 0.1**
Revenue from Ultimate Customers (Net after refunds, etc.)	**$273,362,300**	**$266,855,000**	**+ 2.4**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended November 30th			
Kilowatthours per customer	1,138	1,070	+ 6.4
Average Annual Bill	$40.06	$38.52	+ 4.0
Revenue per Kilowatthour	3.52¢	3.60¢	− 2.2

(*) By courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 13 MARCH, 1945 No. 3

Preplanning for Major Emergencies

How It Is Done by the Boston Edison Company

By T. H. Haines

Assistant Vice-President, Transmission and Distribution, Boston Edison Company

Presented before the Transmission and Distribution Committee, E.E.I., Pittsburgh, Pa., February 15, 1945

IN the past the Operating Departments of the Boston Edison Company have recognized the possibility of certain emergencies involving the electric and steam plant and have prepared operating routines for use in such eventualities.

The experience of the Company during the period of rehabilitation following the New England Hurricane of September 21, 1938, however, demonstrated the desirability of establishing a more complete and coordinated procedure, readily adaptable to all possible contingencies of sufficient magnitude to be considered in the category of "major emergencies."

During the next year, such a coordinated procedure, or master plan, was developed through the cooperation of all Departments of the Company. The background of experience contributed by employees of the Company who were in key positions during the service restoration period following the 1938 hurricane was supplemented by information obtained from utilities that had experienced such disasters as hurricanes, sleet storms, floods and earthquakes. From these and other sources of information, the organization plan had been completely developed by September, 1939, and was ready to meet its first test.

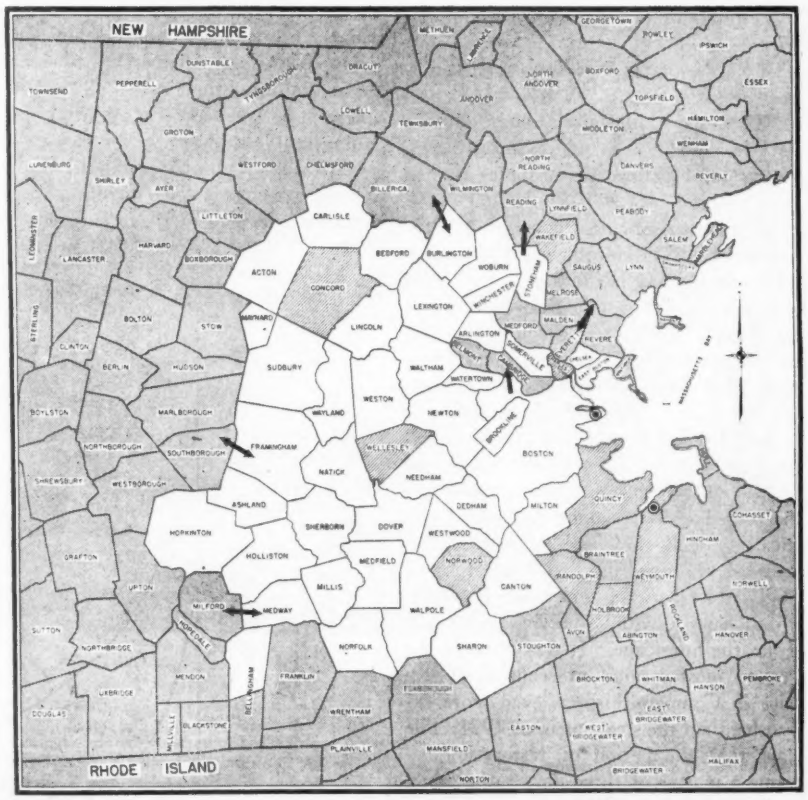
Since the 1938 Hurricane was the first to visit New England in approximately 100 years, it appeared likely that this test would be provided by another type of emergency, possibly a sleet storm or enemy bombing.

That we were to be surprised was evident early on the morning of September 14, 1944. At that time the Company was advised by the Weather Bureau of the approach of a tropical storm and on Thursday and Friday, September 14 and 15, the 40 cities and towns in the 600 sq. mile area served by the Boston Edison Company experienced another hurricane, the second within six years.

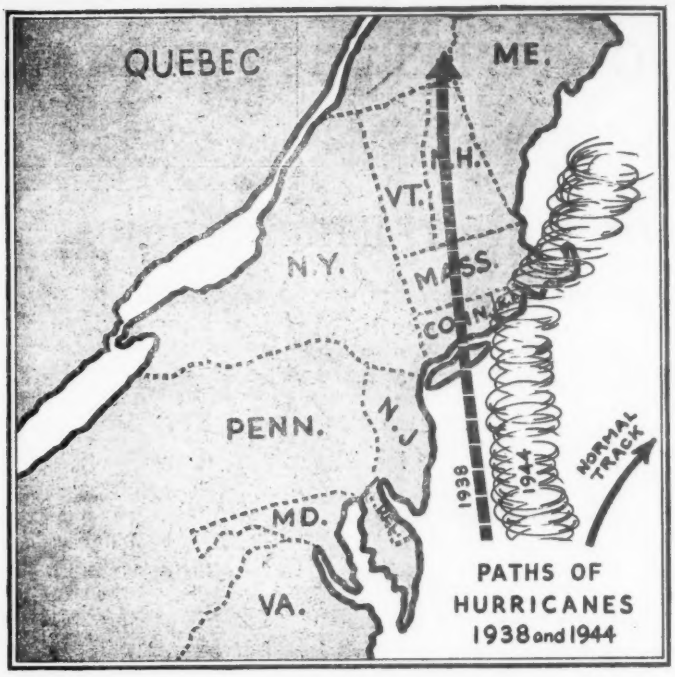
While the advance reports of this 1944 hurricane indicated that it would be of equal severity and gave every indication of being as devastating as its predecessor, a last minute shift in its path saw the center of the storm pass out to sea a few miles southeast of Boston. As a result the destruction of trees, poles and customers' services in the territory served by the Boston Edison Company was not comparable with that caused by the 1938 hurricane, when the center of the storm was to the west of Boston.

In 1938, the storm center followed the Connecticut Valley and Boston was exposed to the velocity of the whirling vortex plus the velocity of the rate of travel of the center of the storm.

In 1944, although the storm center passed close enough to Boston so that the calm of the core area was felt, the veloc-



Territory served by Boston Edison Company



ity of the rate of travel opposed the velocity of the vortex.

Six years ago, of our 400,000 customers, 292,000 were without service on the night of the hurricane.

A day later 172,000 were without service.

Two days later 126,000 were without service.

Three days later 93,800 were without service, and it was approximately two weeks later before all customer service was restored.

By comparison, on the night of September 14-15, 1944, the electric service of approximately 184,000 of our 400,000 customers suffered some interruption but in a great many cases the interruptions were momentary or of such short duration that little inconvenience was experienced. At the end of 24 hours, it is estimated that not more than 50,000 customers were still without service and at the end of 48 hours this number had been reduced to about 10,000. Practically all of these were cared for on Sunday, the third day, after the storm.

These statistics do not mean, however, that there was only minor destruction from the hurricane. It was actually the second most serious interruption of service in Company history, even more extensive than the sleet storm of 1921. The fact that the period of restoration became a matter of three days rather than two weeks, as in 1938, was not accomplished without most effective work by all concerned and most of all by valiant work by our line crews, aided by careful planning and adequate preparation.

In developing our emergency organization, two factors were considered of prime importance, namely:

(a) The plan should be sufficiently comprehensive to adequately provide for organizing and supervising all activities likely to be necessary during any type of emergency imaginable.

(b) The organization should be flexible in order that each major unit may function independently, or in conjunction with other units of the emergency organization or with indirectly affected departments carrying on normal routine activities.

From the above, it is evident that the procedure for coordinating the numerous and diversified activities, must be somewhat involved. It seems best, therefore, in this paper, to limit the description of the emergency organization plan to its application to the hurricane type of emergency.

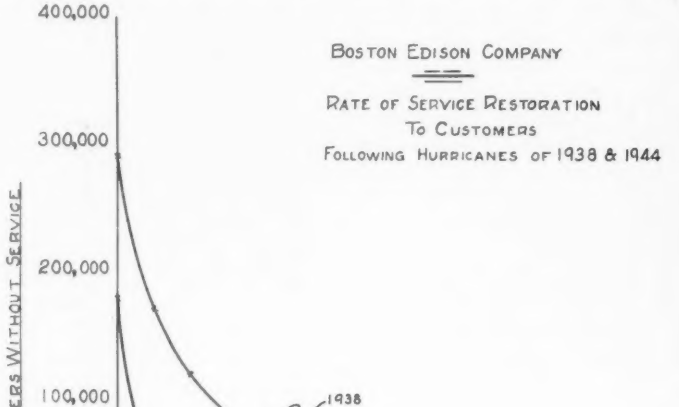
1. Emergency Administrator

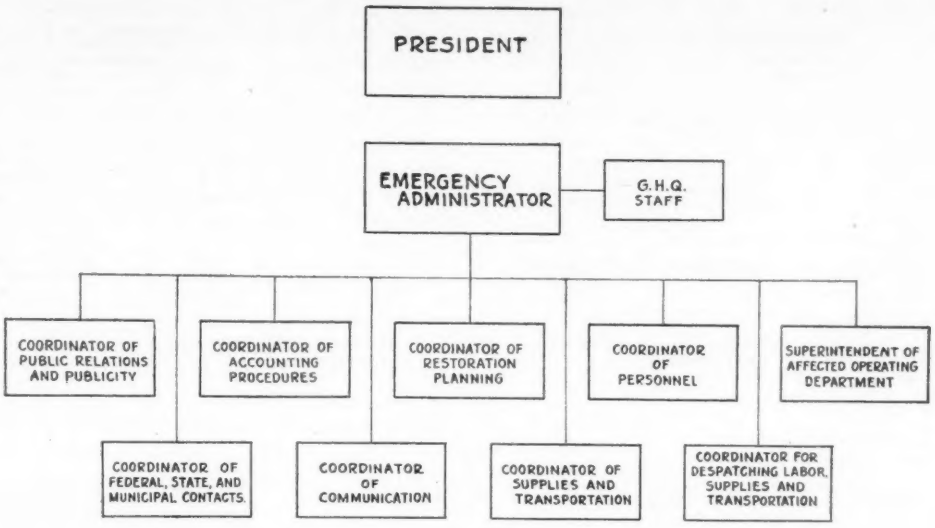
The plan provides for the appointment by the President of an Emergency Administrator who carries this designation when conditions are normal as well as during emergencies. In this way, the plan is reviewed, amplified or amended when experience dictates or when there is any change in the Company's operating organization.

When emergency conditions prevail, the President declares a state of emergency through the Emergency Administrator who, with the collaboration of the General Headquarters Staff, sets up and administers the emergency organization. During this period, he is empowered with full authority over all Company activities.

By setting up the Emergency Organization on the morning of September 14, a great many things were done by early afternoon that had not been put into effect until two or three days after the 1938 hurricane.

For instance, the key personnel directing the various emergency units were assembled while the hurricane was still




PRESIDENT
EMERGENCY ADMINISTRATOR
G.H.Q. STAFF
COORDINATOR OF PUBLIC RELATIONS AND PUBLICITY
COORDINATOR OF ACCOUNTING PROCEDURES
COORDINATOR OF RESTORATION PLANNING
COORDINATOR OF PERSONNEL
SUPERINTENDENT OF AFFECTED OPERATING DEPARTMENT
COORDINATOR OF FEDERAL, STATE, AND MUNICIPAL CONTACTS
COORDINATOR OF COMMUNICATION
COORDINATOR OF SUPPLIES AND TRANSPORTATION
COORDINATOR FOR DESPATCHING LABOR, SUPPLIES AND TRANSPORTATION

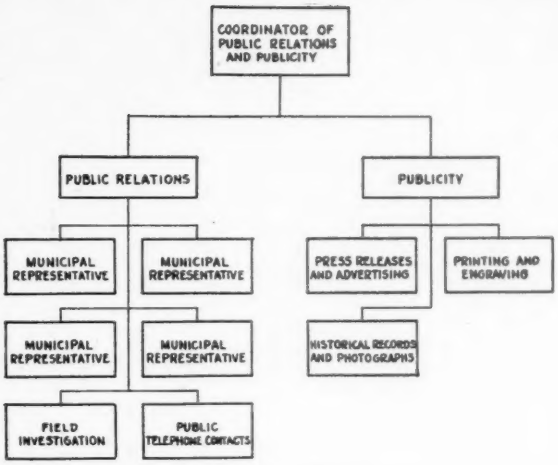
BOSTON EDISON COMPANY.
EMERGENCY ORGANIZATION

many hours away and all employees of the field, shop, and office forces whose services could be utilized were given immediate assignments or requested to stand by at the end of their shifts that afternoon. Tree expert companies, and regularly employed contractors with line crews, were notified to expand their forces insofar as possible and were issued instructions to report at specified work locations in the morning. Additional trucks were equipped without delays for general tree clearing work and all equipment was serviced for emergency duty.

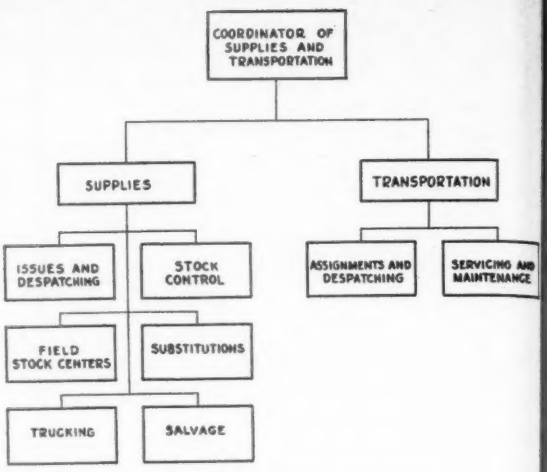
Many hours before the hurricane of September, 1944, reached the Boston area, executives of the Boston Edison Company who direct the Emergency Units met at Emergency "GHQ" with President Toner to set in motion plans previously made for handling such situations.

Standing are R. E. Dillon, Assistant General Manager and Chief Engineer; J. V. Toner, President and General Manager; J. T. Ward, Vice President and Director of Steam and Electric Operations; L. L. Edgar, Vice President Fuel and General Purchasing.

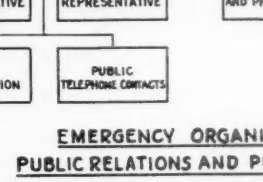
Seated, beginning with left foreground and reading clock-wise: T. H. Haines, Asst. Vice President and Supt. of Transmission and Distribution; E. J. Hyland, Treasurer; T. H. Carens, Vice President Public Relations, Promotion and Merchandising; H. W. Wellington, Superintendent of Production; C. A. Corney, Asst. Vice President and Supt. of Engineering; D. E. Washburn, Power Sales Manager; A. J. McEachern, Industrial Relations Manager; A. C. Havlin, Assistant Treasurer.



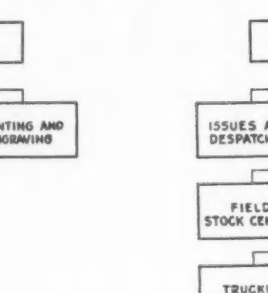
EMERGENCY ORGANIZATION
PUBLIC RELATIONS AND PUBLICITY.



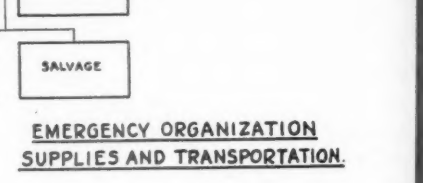
EMERGENCY ORGANIZATION
SUPPLIES AND TRANSPORTATION.



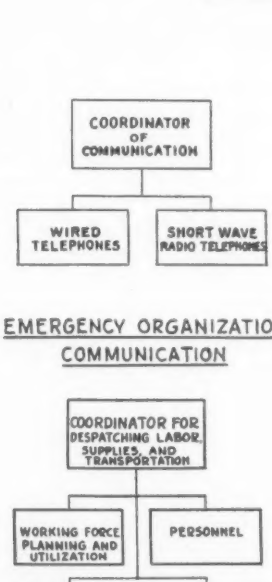
EMERGENCY ORGANIZATION
FEDERAL, STATE AND MUNICIPAL CONTACTS.



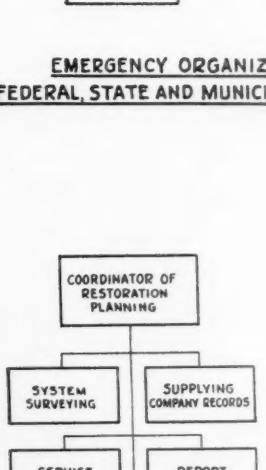
EMERGENCY ORGANIZATION
COMMUNICATION



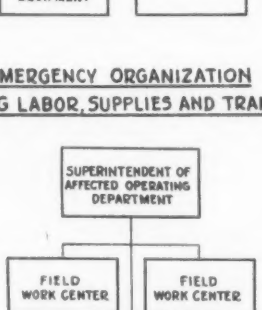
EMERGENCY ORGANIZATION
ACCOUNTING PROCEDURES



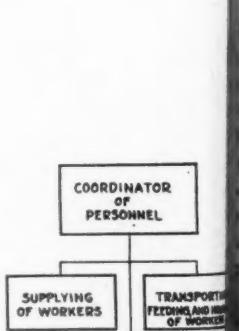
EMERGENCY ORGANIZATION
DESPATCHING LABOR, SUPPLIES AND TRANSPORTATION



EMERGENCY ORGANZATION
RESTORATION PLANNING.



EMERGENCY ORGANIZATION
AFFECTED OPERATING DEPARTMENT



EMERGENCY ORGANIZATI
PERSONNEL

Organization Charts of Emergency Units, Boston Edison Company

Preliminary surveys and estimates of material requirements and available substitutes were made and arrangements completed to secure needed quantities immediately.

Arrangements were also made with several public utility companies outside the path of the approaching hurricane as far west as Chicago and south to Baltimore for such aid as might prove necessary and they might be able to furnish.

The course of the storm was followed by telephone from noon on with all utility and federal agencies which had pertinent information.

2. Public Relations and Publicity

This important part of the emergency organization was created primarily to provide a means for successfully handling the large volume of requests received from municipal governmental officials and the general public in regard to service restoration information.

Representatives were set up in each city and town on the system to handle public relations problems and report serious interruptions to hospitals, institutions, food plants, dairies and other customers of that nature. Cases requiring special attention were investigated in the field and necessary information thus obtained for consideration of service priorities.

At regular intervals, conditions in the various towns were reported to an Information Center, where hourly bulletins were issued to key personnel in the Emergency Organization and to interested Operating Departments for their information and guidance.

Telephone calls from the general public relative to service restoration requests and information were handled in such a manner as to best satisfy the complainant that his interests were being properly handled. By expanding the telephone facilities and rerouting service calls to designated lines, serious overloading of our Service Despatchers was avoided and satisfactory service rendered to our customers.

Under normal conditions the Publicity Director is responsible for the clearance of all statements to the press. It is extremely important that this practice be adhered to during emergencies and Municipal Representatives and other emergency workers in key positions are so informed in order to avoid undesirable publicity through local newspaper releases from unauthorized sources.

A certain amount of printing is usually found necessary during emergencies to provide window cards for temporary offices in the field and for motor vehicle "emergency stickers." Every Boston Edison car intended for use in the work of restoration was so equipped during each of the hurricane emergencies.

Also, many photographs for historical record purposes were taken in the field during the storm and while the restoration work was in progress.

3. Federal, State and Municipal Contacts

During certain types of emergencies, situations may arise necessitating unusual police or military protection and the emergency organization provides for making arrangements and directing such of these activities as are thought advisable by the Emergency Administrator.

These contacts were established during the emergency period with the First Service Command, the State Guard and Municipal Departments, including police. Through some of these agencies arrangements were also made for housing and feeding of at least 200 men from outside our territory, should it prove necessary.

4. Accounting Procedures

(a) *Emergency Accounting*

This group is composed of the Chief Clerks and clerical division personnel of the affected operating departments together with a centralized staff of selected Accounting Department employees.

In this way, uniform instructions and information regarding emergency accounting requirements are furnished to Working Force Supervisors, emergency field clerks and others concerned.

(b) *Emergency Field Clerks*

The ultimate clearing of emergency accounts requires accurate information relative to work performed and it is the responsibility of the Working Force Supervisors to provide this information. To relieve them of as much detailed clerical work as possible, however, emergency field clerks are immediately assigned to each field work center. These clerks are required to be familiar with time cards and the rules and regulations applying to the working conditions of the various classes of personnel, and function as timekeepers under the joint supervision of the Accounting Department and the Working Force Supervisor to whom they are assigned.

(c) *Emergency Payroll*

This group maintains accurate records of labor and repair costs and is responsible for all activities in connection with the preparation and delivery of the emergency payroll.

5. Communication

It was evident from our studies that adequate communication is a vitally important necessity during times of emergency.

Although there may be times, such as the recent hurricane disaster, when the Company's normal communication facilities are not seriously impaired, preparations have been made, nevertheless, for maintaining communication between selected key points of the system under the worst conditions imaginable.

(a) *Wired Telephones*

Standing arrangements had been made with the local telephone officials whereby important lines are given preferential treatment in regard to telephone service maintenance and restoration during emergencies.

Also, prior to the arrival of the 1944 storm, prompt communication with the Distribution Despatchers and with field headquarters was assured by installing direct telephone lines from Boston Headquarters.

(b) *Company Short Wave Radio Telephones*

As in all former emergencies of lesser degree since Boston Edison's short-wave two-way radio telephone system was placed in operation, the amount of time saved by its use in service restoration work following the hurricane was incalculable. Approximately 550 transactions involving two to more than a dozen transmissions each, were handled during the first 24 hours after we began to have circuit outages.

In addition to 23 mobile units and the fixed station at the Distribution Despatching headquarters, eight fixed two-way sets are installed at Generating Stations, the General Headquarters and in important substations so that in event of complete failure of telephone facilities system despatching may be done by the use of short wave units.

6. Restoration Planning

This element of the organization regularly advises the Emergency Administrator regarding the initial and subsequent magnitude of the reconstruction work to be performed in order that the effectiveness of various planned measures may be observed as soon as possible after each is instituted. It is through this unit that the speed of restoration of service, both for the system as a whole and rela-

tively by portions, is determined and regulated.

(a) *System Surveying*

The duties of this group is to promptly and rapidly survey the extent of the damage and to report for the Emergency Administrator's guidance, the nature, location and amount of damage to the system.

At daybreak on Friday, September 15, when it became possible to determine with some degree of accuracy the extent of damage to the system, such a rapid, preliminary survey was made from each field headquarters. Routes to be covered had been previously selected to provide a representative cross section of each area from which the total amount of damage might be estimated. These surveys were coordinated and supplemented by other observations made during the storm and indicated those areas most seriously affected.

As soon as possible after the preliminary survey, a second detailed survey was made to enable the compilation of a comprehensive list of materials necessary for repair work and to permit the formation of reasonably accurate estimates as to the supplementary personnel and automotive equipment necessary.

The survey functions were continued throughout the emergency in order that first hand information might be continuously available regarding the progress of the specific phases of the restoration work.

(b) *Supplying Company Records*

This group is composed of employees familiar with the Company's records system of overhead and underground plant. Copies of such records are made available, upon short notice, to the Work Centers and all units of the emergency organization requiring this information.

(c) *Service Priority*

The service priority group is established for the purpose of selecting, scheduling and reporting to the Operating Department the customers and circuits that should receive first consideration.

Naturally, during the storm every effort was made to keep services alive to hospitals and similar institutions. This was accomplished with remarkable success, with nearly all services to hospitals restored during the early morning hours of Friday, September 15.

Next in the order of importance were public services, such as Fire Stations, Police Stations, Telephone Exchanges, Water Supply Systems, followed by dairy customers, food storage customers and essential war industries.

(d) *Report Center*

Through routine progress reports received by this group, a visual record of the status of the restoration work over the entire Boston Edison territory was continuously available. This record was used as a guide by the management in re-allocating field forces to secure best results and was also very useful to those handling Public Relations and Publicity.

As portions of primary lines were restored to service, records at field headquarters were so marked and the information immediately transmitted over direct telephone lines to the Report Center. At the Report Center, this information was recorded directly as received by marking the circuit print lines in red pencil to indicate those portions which had been made alive.

Upon completing the restoration of service to customers, the same procedure was followed in each area in the restoration of street lighting. Nearly all of the street lighting circuits were operating normally by the Tuesday evening following the storm except for the burned out lamps caused by primary crosses.

Patrol crews were organized to locate and replace these lamps and thereby complete the restoration of service to all classes of load.

(e) *Meteorological*

It is the duty of this group to obtain and distribute pertinent meteorological data, as available from the United States Weather Bureau service and all other sources.

Two men were stationed at the Weather Bureau station at East Boston during the storm whose duty it was to keep General Headquarters fully informed of all details of the aproaching storm.

(f) *Engineering*

Engineering details of the reconstruction program are determined by this group, as required.

An important initial duty, when necessary, is to act promptly in determining the maximum extent to which plant may be returned to service by segregating defective portions. Any necessary steps are also taken to insure that parts of the system still in operation or returned to operation will continue to render satisfactory service.

The nature of the 1944 emergency, however, was fortunately such that plant engineering problems were a minor consideration.

7. Supplies and Transportation

The various groups in this unit assume full responsibility for procuring and issuing materials, tools, equipment, vehicles, and transportation as determined by the nature of the emergency and the requirements of the working forces. In addition, material removed from the system is salvaged and vehicles maintained and serviced.

A pool is established of all automotive equipment and vehicles available for emergency work are assigned to authorized persons in accordance with rules established for the emergency.

Care is taken at temporarily established field stock centers to ascertain that stock is properly sheltered and guarded against theft at all times.

8. Personnel

(a) *Supplying of Workers*

Procuring the necessary personnel required by the various emergency groups is the important function of this group. Authority is granted to temporarily transfer workers from one department to another without observing the customary formalities, provided that such action does not interfere with operating routines which must be maintained during the emergency.

In connection with the allocation of supervisory assistants, survey men, and other skilled workers from within or outside the Company, care is taken to distribute desirable talent as uniformly as possible among the work centers requesting aid.

(b) *Transporting, Feeding and Housing of Workers*

Although assistance from other utilities was not required during the 1944 emergency, it is the function of this group when necessary to meet workers arriving from distant points and to arrange for their transportation, feeding and housing.

While these workers are usually accompanied by a supervisor who is expected to assume responsibility for their health, financial needs and general welfare, etc., it is nevertheless a function of this group to see to it that such workers are cared for properly.

(c) *Accident Prevention and Investigation*

The large scale activities generally associated with major disasters usually result in a greatly increased force working

abnormally long hours under adverse conditions. These conditions place a responsibility on Management to be especially watchful in order that cases of accident or illness promptly receive proper hospitalization, surgical or medical attention.

The investigation of industrial accidents is normally a function of the Company's safety engineer and the added supervisory responsibilities of this nature are also carried on under his direction during emergencies.

(d) *Medical*

The functions of the Medical Director during emergencies, as during normal periods, are largely advisory in character and local physicians and hospitals are relied upon to a great extent to care for workers disabled through sickness or accident.

It was a source of great satisfaction to all that not one single case of personal injury to any employee or to any employee of contractors working on our lines was reported during the 1944 emergency.

Considering the great number of potentially hazardous conditions which existed due to hurricane damage to our construction, we feel that such a record must be in a great part due to the fact that our men continued to use proper work methods even under the most trying conditions.

9. Despatching Labor, Supplies, and Transportation

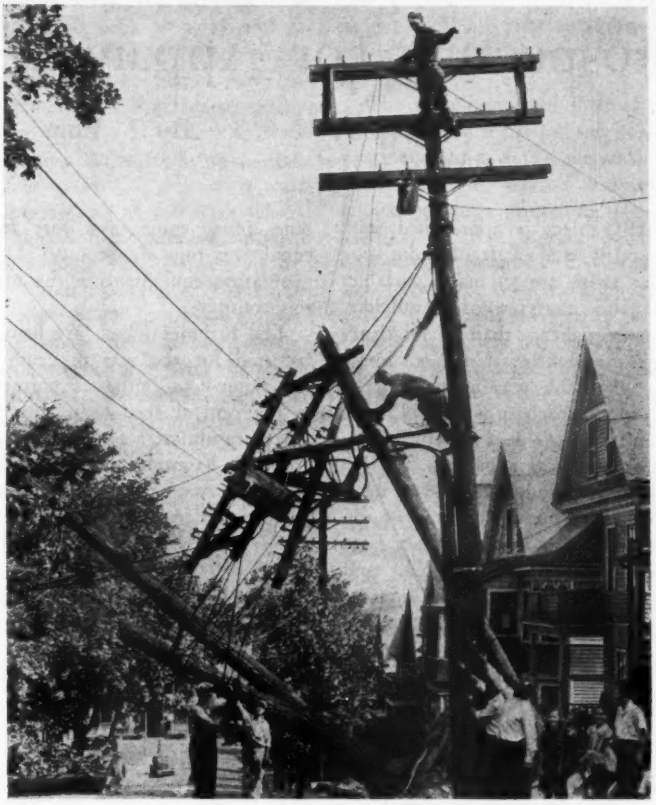
This unit provides a contact between the affected Operating Departments and other units of the Emergency Organization whereby arrangements are made for the assignment, replacement or release of field working forces, vehicles, and such tools and equipment as are not available from the local stock centers.

Also, in cooperation with the Restoration Planning group, the manner in which the working forces are integrated, equipped and despatched is outlined, care being observed to suit each assignment in accordance with its relative importance.

10. Affected Operating Departments

Affected field operating departments are regarded as major units of the emergency organization. Superintendents of such departments are considered in the same category as Coordinators of other activities and are under the direct supervision of the Emergency Administrator.

Supplementary personnel assigned to skilled or unskilled manual work normally performed by such departments are placed under the direction of the operating department's regular supervisory staff. This applies whether workers are temporarily transferred from other departments within the Company or obtained from sources outside the Company.



Hats off to the Line Crews—Careful planning and adequate preparation, effective work by all concerned, and most of all, valiant work by the line crews, hastened restoration of hurricane damage.

In the 1944 emergency, as in 1938, the Transmission and Distribution Department was the operating department principally affected and all available employees of the line forces worked continuously through the night of the storm and until dark or later on Friday evening. Work was also carried on during the daylight hours on Saturday and Sunday in order that service to all customers might be restored as promptly as possible.

The highest praise was earned by these men of the line force who worked long hours, and in the wind and rain, to carry out the actual physical work connected with the restoration of service. Without them, all of our planning would have been in vain.

As in 1938, major difficulties were brought about by fallen trees and limbs. Although not many poles were broken, there were innumerable fallen and burned primary, secondary, and street lighting wires and many branches resting on and hanging from the wires. The quantity of trouble with customers' overhead services was not large enough to be serious.

The volume of tree trouble requiring clearing was relieved to some extent by the additional crews obtained from tree expert companies and local contractors, as well as by employees of unaffected departments, who supplemented line crews and formed additional crews for tree removal work.

As tree conditions improved the unskilled labor furnished by contractors and other departments was gradually withdrawn and the restoration of wires and services by our own and contractors' line crews continued.

Incidentally, several cases of blown primary fuses and defective transformers were encountered due to a lightning storm that accompanied the hurricane in its early stages.

In concluding the description of our emergency organization, it should be pointed out no attempt has been made to touch upon the specific office locations and layouts or the many channels which provide contacts between the various emergency groups in carrying on the inevitable office routines. While these activities were considered and are included in our master plan, such detailed planning is best developed independently to suit the particular organization of the individual Company.

It should also be recognized that many of the activities outlined above as separate functions may be combined in certain instances and become the responsibility of a single group or individual as the occasion requires.

Author's Note—The author wishes to expresss appreciation to Mr. J. F. Archibald, head of the overhead section of the Transmission and Distribution Department, Boston Edison Company, for his assistance in the preparation of this article.

Prospecting for Apparatus and Merchandise

By T. Fort

Manager Central Station Sales Dept., Westinghouse Electric & Mfg. Co.

THIS subject is approached with humility and a frank admission that there are so many variables in the equation that few of us can look much farther ahead than a relatively few weeks or months. Until we know definitely that the war is nearing its end, we cannot prophesy what 1945 will hold in either the field of electrical merchandise or electrical apparatus.

Inasmuch as nobody can tell you what 1945 holds for you in the way of obtaining apparatus and merchandise, I am going to do the next best thing and draw for you a picture of conditions as they appear today in the electrical industry. From this picture we may be able to take situations as they change during the year and figure out for ourselves what the changing outlook on the apparatus and merchandise fronts will be. Naturally, most of the examples will come from my own company, but I believe our situation is probably typical of the electrical manufacturing industry.

To begin this story, let's suppose that having been out of the market for some years, you are in the market today for some steam generating equipment. You are interested in how your supplier's situation has changed during the past several years. The first thing which would startle you is how the steam turbine and condenser business has grown during the war. The Navy and Merchant Marine had an insatiable appetite for steam turbines and condensers during the past four years. Manufacturers of steam equipment are today putting out their products in a volume probably five times their heaviest previous rate. Only a trickle of their capacity is being allowed to go to the public utility industry. Most turbines being manufactured today are a single purpose specialty, largely high speed turbines which are generally connected through reduction gears to propeller shafts. In horsepower, the annual output of steam turbines today could in a very few years equal the total horsepower of all the generating equipment in the utilities of this country.

The turbines which are being manufactured for the war program are not the tailor-made product normally sold to the central stations of this country. They are almost a semi-mass production product. From this type of production experience we have learned much which will help us in the postwar market.

But what about your own turbine which you may be interested in this year or next? The ability of the turbine manufacturer to deliver your equipment will rest entirely with the scheduling authorities of the Government. If the Government would allow us or any other well known turbine manufacturer to squeeze your order into our schedule there is no doubt that the job could be easily handled. Manufacturing the turbine requirements of the country for the central station industry would be a "cinch" compared with the wartime job of turbine manufacturing.

Let's leave the steam end of your generating station and go to the electrical end. Or, perhaps you do not have a steam generating station but are interested in expanding a hydro-electric generating plant, or want some other type of large rotating electrical equipment. Very strangely, the electric generator manufacturers of the country are in quite a different situation from the steam equipment manufacturers. This is a good illustration of how wartime manufacturing operations are disjointed when compared with peacetime. I think you will be interested in why this is the case. One big reason for this condition is that most of our ships are being driven by turbines connected to propeller shafts through reduction gears. Thus, most of the turbines made today do not need any generators. Next, the generator manufacturers did an enormous job early in the war building rectifiers for the aluminum and magnesium programs. This rectifier job is virtually completed. Next, the manufacture of generators for power generation is today on a very small scale. Large rotating machinery for the steel, synthetic rubber, and other programs is pretty well completed. The only programs which are continuing on a large scale are for export projects.

Therefore, the generator manufacturers of the country which early in the war were producing at about twice their peacetime rate, have now lost a large part of their load. Their ability to handle business today is not limited by capacity or crowded schedules, but because the WPB is still very heavily restricting the manufacture of generating equipment.

Let's leave the field of generation and go to the manufacture of equipment for the transmission and distribution of electric power. There are probably many purchasing agents who have had serious headaches in connection with procuring switchgear equipment for your electrical systems. Switchgear has been and is one of the most critical items on the war program today. We thought we were doing a large switchgear business in 1940. However, our output of switchgear in 1944 was over three times the output in 1940. In spite of this your industry probably received only about one-quarter of the switchgear you received in 1940—war demands have almost squeezed you out.

To put out the large volume of switchgear manufactured last year, much of the technique of making switching equipment changed greatly. This is particularly true of switchboards. Large orders for switchboards have been placed by the Navy calling for many duplicates of the same equipment. This has enabled switchgear manufacturers to set up production lines and manufacture this type of equipment in quantities which were never before possible. Large programs of development have had to be carried through to design switching equipment so that it would withstand the explosive impact experienced in battle. These impacts are so great that they may break the legs of switchboard operators standing on the floor supporting the switchboards, yet the switching equipment must still stand up.

To sum up the situation on switchgear, you will still have difficulty for

This paper was originally prepared for presentation before Public Utility Group of National Association of Purchasing Agents. The meeting was scheduled to be held in Pittsburgh, Feb. 1 and 2, but was called off to conform to order of Director Byrnes.

a time in obtaining deliveries of this class of apparatus, but if so, you are only being inconvenienced due to the critical need for electrical switching equipment in every phase of our wartime operations.

In the transformer manufacturing field we find two problems—one in connection with power transformers and the other with distribution transformers. The construction programs of the early war years placed heavy loads on the manufacturers of power transformers. Production in this field went up close to 200 per cent of prewar levels, but today, due to the virtual completion of the wartime construction program, power transformer manufacturers are in a situation comparable to that of the electric generator manufacturers. Their ability to produce equipment is today limited by lack of orders.

The only bottleneck today in the transformer manufacturing industry is in the field of small distribution transformers largely used for rural electrification. How this bottleneck developed is interesting—

In 1943 the demand for small distribution transformers dropped off to a point where production was only about one-fifth of the average peacetime demand. Many of the facilities for manufacturing transformers were converted to making radio and radar transformers and other small transformers needed by the Armed Services.

However, early last spring the WPB allowed increased purchases of transformers for rural electrification. The demand for these transformers rapidly increased and today the demand is still in excess of the supply. Steps have been taken to increase production of these small rural electrification transformers as fast as possible without interfering with the war effort. I feel that during the coming year transformer manufacturers will be fully able to meet the demand for these units. This will be done without penalizing the many important war contracts which the transformer manufacturers are carrying on.

Watthour meters are a critical item in your industry today. This is true because the watthour meter manufacturers have had to give preference to the manufacture of instruments for the Army and Navy over all other orders. Our production of instruments last year was more than ten times the number we built in 1941. Our output of watthour meters was only the small number which the WPB allowed us to squeeze in. When you think back to 1941 and recall the stories of airplanes being manufactured but which could not leave the ground because of a shortage of instruments, you will not be critical of watthour meter manufacturers who have been unable to provide you with watthour meters as fast as you have wished them. The manufacturers of electrical instruments today are abreast of the country's aviation program. Their ability to do this has been in a large measure due to the support they received during the years before the war from the public utility industry. Your support prior to the war built the meter and instrument facilities of this country to a very large extent. Immediately our wartime job is done we can be back to the prewar level of watthour meter manufacture in thirty days.

One of the most important concerns the public utility industry has today is —when will new electric appliances be on the market? Your welfare is in a large measure dependent upon your customers being able to buy power consuming devices. Therefore, many of you are probably far more concerned about appliances than you are about apparatus. Because, if your customers cannot obtain appliances you are not going to need very much apparatus.

When the WPB allows us to again go back into production of appliances we feel it will require about four months to get material and start production. It will then take us one month to fabricate parts, and actual production of appliances will start within five or six months after clearance is received from the WPB. After production starts it will take some little time to produce enough appliances to fill our various channels of distribution and actually get appliances in sizable quantities into the hands of users.

The immediate postwar appliances will not be very different from the ones on the market in 1940 and 1941. These appliances had a consumer acceptance far beyond their availability and the demand has been pyramiding since then. Many new models were announced before production was stopped. Thus, by going back into production on the basic designs of prewar, we will be accomplishing the best results for the consumer as he will get quality proven merchandise quickly—for the dealer and distributor we will get him back into the appliance business with no risk of untried production. This is the best way to get back into the appliance business as quickly as possible when restrictions are lifted.

The most important load of the public utility is still the lighting load. Your prosperity in a large measure depends upon the ability of the electrical industry to continue promoting the lighting business and that lighting equipment be continuously available in large quantities. This fact is increasingly important today due to the advent of the fluorescent light which has had the effect of revolutionizing the lighting business.

Immediately after the war many thousands of commercial establishments and industrial concerns over the country are going to convert to fluorescent lighting. It is important that the electrical industry be ready to use this opportunity to raise levels of illumination. The lamp manufacturers are getting set to meet this unprecedented demand for fluorescent lamps. This business has stepped up to a point where today six times as many fluorescent lamps are being turned out as were being produced in 1940. This business will also be greatly stimulated by the fact that the price of the fluorescent lamp is today less than half what it was in 1940. If adequate lighting goes hand in hand with the general adoption of fluorescent lighting, this new, more efficient lighting source should cause an increase rather than a decrease of load for public utilities.

I think you will also be interested in how war industry has caused a great increase in the production of high wattage lamps which are largely used in industry. The production of high wattage lamps has doubled in certain ratings and tripled in others since the war began. This indicates to us that the industry generally is more conscious of the benefits of good lighting than has ever been the case before. Also, 90 per cent of the lighting fixtures in commercial establishments are obsolete today. There will be a rush to replace these when the war is over.

I have given you a rather quick review of the situation in which the electrical manufacturer finds himself today. From this resume I hope you may in some degree gage what you will be up against this year from the standpoint of procuring electrical apparatus and appliances.

You have another very serious concern which I am going to touch on. The

public utility industry has been pretty much out of the market for equipment during the last two years. You have a sizable backlog of delayed purchases. It is a serious concern on your part that perhaps at the time when you come back into the market you may step into a period of inflation and high prices. You are greatly concerned as to what is going to happen on prices.

I cannot give you an answer as to what is going to happen. I do not think any one company or any one industry can give you the complete answer because there are many factors in the price situation beyond the control of any one company or any one industry. However, there are things we can do which will help to keep prices down. Probably the least of these is continually yelling that labor costs must go down.

One of the apparent paradoxes of wartime operation has been the fact that labor costs have gone up on an average of over 40 per cent; material costs have also increased, and yet manufacturers have been able to produce many items of electrical apparatus at lower prices than before the war. This has been done even with a large percentage of new help in our factories.

Actually, the reason for this is not at all mysterious. Overall costs have not gone up in proportion to increases in labor and material costs, due—first to greatly increased volume; second to continuous improvement in manufacturing processes, and third to concentration on standardized equipment. Prices after the war will, in a large measure, have to reflect not only labor and material costs, but these other three fundamental factors.

Let's see what can be done cooperatively about these three items of cost:

First—increased volume can only come by increasing the use of electric power. The utilities and the manufacturers must join hands to promote in every way possible the greater use of electric power.

Second—improvement in the use of manufacturing facilities. This is a job for the manufacturers. I think I can safely say that the competition is so keen between electrical manufacturers that you need have no fear of their failure to continuously improve their manufacturing operations.

Third—the increased use of standardized equipment. Here is a job in which those who purchase for electric utilities have the major responsibility. By purchasing as much of your equipment as possible in accordance with standardized industry specifications, the economies of quantity production can be brought to many lines which heretofore have been individually manufactured.

Will carrying out these three objectives serve to keep prices down? I think there can be no doubt of it. I am going to give you one example of how the electrical industry has been able to pass on to its employees and to its customers the benefits of greater volume and improved manufacturing processes. We recently made a study of costs and selling prices of a 5 hp motor over a period of 30 years. The hourly rate for labor today in the sections where motors of this type are made is approximately 4½ times the hourly rate paid in 1914. The material cost is about the same. The motor today is a better motor in many ways than the one manufactured 30 years ago. The selling price of the motor is about 5 per cent less than the selling price in 1914. What does this mean? It means that manufacturing economies due to better methods and increased volume effected over a period of years by the electrical manufacturing industry, have been passed on to the people who labor to make our products and to the customers who use them.

Out of wartime experiences we have learned new things in the field of manufacturing. We have found that there are many additional products which can be manufactured according to standard specifications at lower costs. One of the best examples of this is in the field of metal clad switchgear. Specifications have been pretty well standardized during wartime and almost all of the industrial power supply substations have used standard metal clad switchgear. This class of apparatus is today selling at a considerably lower price than in 1940, and this is largely due to standardization.

The AIEE and ASME have joined hands and prepared standard specifications for turbine generators. Representatives of the utility industry led in the preparation of these specifications. It is hoped that the adoption and use of these turbine generator standards will effect savings as compared with prices of specialized tailor-made equipment. Circuit breaker standardization moves are in progress. Similar moves are under way on transformers. This standardization movement will receive the whole-hearted support of the purchasing agents of utility companies, I am sure.

I will admit that manufacturers have been in a large degree at fault for the slow adoption of standardized equipment in the utility industry. There has been very little incentive given to buy standard apparatus. My feeling is that the present standardization movement is sufficiently strong to enable manufacturers to really effect economies in manufacture of standardized products. If this is true it will be inevitable that appreciable savings in price will result from the use of standard equipment. An industry slogan should be "Let's make it standard."

In making these three suggestions I would like to give this word of caution! These steps will help to keep prices down, but they cannot be considered insurance against price rises. Prices may go up, but their rise will be minimized if all of us in the electrical industry do everything we can to keep them down.

The purchasing agents of the utility industry will have another important responsibility when wartime restrictions are lifted. This is one of helping to prevent an inventory boom in the products which you buy. It is generally admitted that for a time after restrictions are lifted the demand for many products will exceed the supply. Manufacturers will have to resort to temporary rationing or allocation of certain items. They will need your help in equitably distributing the supply of these items until normal production can be re-established. Private industry will probably be under its severest trial during the period immediately following the lifting of wartime restrictions. We must cooperate to prevent abuses which may occur at that time.

In conclusion, I would like to give credit to the utility industry for a large part of the ability of my company to be a major participant in the country's war effort. Down through the years almost one-third of the apparatus the Westinghouse Company manufactured was used by the public utility industry. Your industry cooperated with us in our developments and supported our factories with your orders.

At times during the war, less than 2 per cent of the apparatus we were manufacturing has gone to your most important industry. This has been a forced separation on our part. In our postwar planning and thinking your great industry is given the major position it so justly deserves.

Story of One Electric Company's Part in the War

Philadelphia Electric Company's Employees Share Credit in Meeting the Big Test

By Horace P. Liversidge
President, Philadelphia Electric Company

An Address before Joint Meeting of Philadelphia Section, American Society of Mechanical Engineers and American Society of Civil Engineers

IN the war with Spain and in World War I, as well as now, the Philadelphia area was and is a most important war production center.

Actually, battle tools are being produced here today at a rate that would have seemed fantastic a few short years ago. Never before have Philadelphians had the honor of taking such a vital part in arming and equipping soldiers and sailors for service against our enemies. Never before have they done a better job!

Philadelphia Electric service has been kept available, throughout this war period, in sufficient quantities to satisfy all demands created by this record-breaking production. Reduced to simple figures, the electric peak load today is nine times the peak of World War I and just about 100 times the peak in '98.

Territory Served

The area served by the Philadelphia Electric Company comprises 2224 square miles. Nearly 3,000,000 people live here.

To supply our customers in this area, there are six major steam generating stations, the Conowingo hydro-electric power plant, a four-state interconnecting power pool, substations, transformers, hundreds of miles of overhead lines and underground cables, hundreds of thousands of service connections and meters.

In addition, there are five gas production plants, fourteen storage holders, eleven compressor stations, many miles of tranmission mains, and service pipe lines.

There are also four production plants for localized distribution of live steam.

All of these are only some of the "items" that make up the physical plant of the Philadelphia Electric Company, which is rated among the largest producers of electric power in the world. In gas production capacity, it ranks ninth in the nation.

Power for War Demands

We cannot, of course, determine exactly how much energy we supply for war production. However, an analysis of the power requirements of war plants in this area, such as the shipyards, arsenals, steel works, and other heavy industries, disclosed that the maximum demand of 104 of our largest war customers, over the past twelve months, was about 325,000 kw. Their annual use of energy amounted to 1.7 billion kwhr! This total may not seem to some persons so great in comparison with the astronomical figures we see and hear frequently, but actually it is equivalent to the electrical energy requirements of a city of 850,000 people!

Power Never Too Little Nor Too Late

In these days of shortages, it is comforting to know that not one war plant in the five-county area served by the P. E. Co. has had its war production restricted or delayed because of a lack of power; nor has any farm, residence, or commercial customer had to limit his use of service because of rationing.

As a matter of fact, we have had service available for all war plants and military installations ahead of the time it was required. We have started construction work prior to the formal signing of contracts, whenever necessary. Temporary service was installed at numerous locations on very short notice to expedite war construction.

Advance Planning

Our ability to have power ready where it was needed did not just happen. Behind this accomplishment is a competent organization, with sights set high, whose business it is to provide dependable service come what may. Thus, when Hitler invaded Poland on September 1, 1939, the Philadelphia Electric Company had a most accurate program of expansion covering the succeeding five years, and even the five years from now. In the late thirties, the necessity for expanding our capacity was anticipated, and as a consequence of the building we did then, new plants and equipment were ready when needed. It takes almost three years to build a generating station, from the design stage to actual operation, and the only way to overcome this long construction period is to get started that much earlier.

Here are some examples of what the P. E. Company actually provided:

A new 50,000-kw topping turbine was installed at Schuylkill Station in 1938.

A new 56,000-kw topping turbine was installed at Chester Station in 1941.

Another 90,000 kw were added through the installation of a new condensing unit at Chester Station in 1942.

At Deepwater Station we installed a 20,000-kw unit to supply steam and power to the du Pont Company in 1942.

Gas production was increased 10,000,000 cubic feet daily by a battery of 25 new coke ovens at Chester in 1942.

Much of this construction work was done at a time when ample labor and material were available, when the creation of new things helped the economic situation.

In comparison with the amount of capacity added, our system peak grew from 907,000 kw in 1939 to approximately 1,250,000 kw in 1944, with the total output in this same interval increasing from 4¼ to an estimated 7¼ billion kwhr!

Likewise, the maximum daily sendout of gas increased from 42 million cubic feet in the winter of 1939-40 to an estimated 72 million cubic feet this winter. The total annual sendout of gas, which was slightly more than 9 billion cubic feet in 1939, will, we estimate, increase to 14 billion cubic feet this year.

Reduced Spare Capacity

I am sure you do not have the impression that throughout this war emergency we have had all the spare capacity we wanted. We didn't! When the war halted all new construction not absolutely necessary for war production, we had to stop work on our new Southwark Generating Station, which was then well under way, with the hope that it would be ready for today's needs. Despite this unexpected turn, we have been able to meet all demands.

In the public utility business we cannot afford to take chances. We cannot operate on the basis of simply "getting by," but must schedule the installation of new capacity so that we will always have available spare capacity to replace the failure of equipment during the period of maximum demand, with some leeway for unusual increases in demand above the normal increase which we have estimated. Under war conditions, we are operating with less spare capacity than is desirable in normal times. This is a situation, however, which is recognized and expected in war time, since every pound of material which can possibly be spared must be put into war equipment, and not utilized to obtain an extra margin in safety of operation. Because of this reduction in available spare capacity, the policy of preventive maintenance which we have pursued for years, together with careful operation, has permitted us to keep machines running longer hours without repairs than would otherwise have been the case.

Preventive Maintenance

By preventive maintenance is meant: *First,* the careful analysis of machine failure to determine the cause of failure, and the making of repairs in such a manner that this same type of failure is unlikely to occur again. This may involve slight changes in design or perhaps change in material. *Second,* careful attention to equipment in operation to determine from its performance the possibility of incipient failures which might lead to more serious ones, and correcting the conditions before the serious failure occurs. I can give a very convincing example to illustrate this type of maintenance:

During 1941, 1942, and 1943 we rebladed some of the wheels of our turbines which might still have operated for another year or two in advance of complete deterioration of the blading. We did this because we knew that with the heavy loads we would experience in the latter part of this period and in 1944 we would have no opportunity to take machines out for overhauling, and that if we did not take time by the forelock we might find ourselves in serious difficulty, due to the reduction in spare capacity.

Along with the acute shortage of materials, we faced another handicap from the loss of 38 of our trained maintenance men to the armed services. In the emergency, other departments, where the war had caused a lessening of activity, transferred some of their employees into maintenance work. For example, chauffeurs became able and willing pipefitters; a janitor was discovered who had been training himself to be a machinist; appliance servicemen changed over to central station equipment servicemen. In addition, a few of the older men of the group, who had attained retirement age, voluntarily decided to stay on until victory.

Loyalty of this kind is typical of P. E. employees. It has been a characteristic of our entire organization ever since I have been around and I have every reason to believe we will continue to have such support. Not only has it proved a potent factor in the record for service we have established, but once again it comes to the fore as a priceless quality in our organization. This faithfulness to duty spells success in emergencies. With it, we have been able to keep more equipment in service for a longer period of time than we ever did before yet the amount of capacity shut down at any one time for maintenance or because of extensive outages has been much lower in comparison with the general average of the industry.

Such results can never be looked upon as "luck" or as an accident. They come from a combination of planning, loyalty, and hard work, plus a liberal portion of "know-how." All of you realize these things cannot be bought; that they cannot be produced in a short time. It is a slow process, which takes years to evolve from a sound program of high standards and exacting requirements.

Therefore it can be said of Philadelphia Electric Company employees, throughout all the various functions and ramifications of our business, that they have exemplified the highest traditions of the industry and have truly lived up to their responsibilities in meeting the requirements of the home front during this war period.

Interconnection

Another very helpful development in the utility business which has occurred in recent years and one that has been of great value to this area in this war emergency has been the perfection of smooth-working interconnection arrangements in important production centers. By "interconnection" is meant (1) the pooling of power by neighboring utility systems and (2) the careful supervision of this tie-in to permit efficient interchange of all power generated by member companies.

The Philadelphia Electric Company pioneered interconnection in this area and participated in its development to the present high degree of efficiency. Our electric generating facilities are now part of a pool aggregating virtually 5 million kw. This pool—which is one of the greatest concentrations of power in the world—co-ordinates all generating facilities in New Jersey, Delaware, eastern Pennsylvania, Maryland, and Washington, D. C.

It is estimated that through this interconnection we have added over 250,000 kw of load-carrying ability that we otherwise would not have had. In addition, this power pool has the added advantage of an interconnection with the generating facilities of New York State, which in turn is interconnected with New England.

Interconnections of this kind are exceedingly effective today. They assure the best possible combination of generating facilities to meet daily demands and a far greater degree of reliability of service for all participating companies than would be possible if each relied solely on its own producing equipment.

Had we been able to complete Southwark as originally planned, its power would have been a great factor in improving the economies of the power pool. This would have helped not only the Philadelphia Electric Company, but the other participating companies as well. As matters have worked out, however, we are buying more power from the pool than we are selling to it.

War Time

I might also add that the introduction of War Time in February, 1942 through Congressional action and the cooperation of the people of this country effected notable savings in the amount of electricity required to satisfy demands. In the area served by the power pool this time change resulted in a saving of some 200,000 kw in winter peak loads. On an annual basis, the saving in power production in this same area amounted to over 120 million kwhr. This is equivalent to a saving of more than 70,000 tons of coal a year!

Fuel Economy

Although both steam and hydro stations are operated by the Philadelphia Electric Company System, steam stations using coal produce the bulk of the energy we generate. In the course of a year we spend a considerable sum for coal, in fact more is paid out for coal than

any other one expense, with the exception of taxes. This year, our coal bill will exceed $17,000,000.

It is only natural that fuel economy should be an important subject with us, and that we should have an organization doing little else than checking this use to assure maximum coal-burning efficiency.

Back in 1903, it took about six pounds of coal to produce one kilowatthour of electricity. We thought that was pretty good, but the utilities and the power plant equipment manufacturers have come a long way since then. We gradually worked this coal rate down until it was less than one pound when the war started. This rate, by the way, was materially lower than the national average.

Coal Distribution During War

In the distribution of coal today, first preference is given to by-product plants making coke for steel plants. Unfortunately for us, much of the better-class coal has by-product qualities! Although they are not essential to us, they *are* important to the coking companies. The result is that much of the better-class coal that formerly came to us is now earmarked for by-product use. Today, we must get along with inferior coal, and the outcome is naturally reflected in our coal rate.

This coal rate is also adversely affected by our being forced to use less efficient generating stations on longer hours of operation, even though the older equipment is obviously less economical to operate. If we had been able to supplement our steam generating capacity by the addition of a new station, as we had hoped, the higher efficiency of this new equipment and the non-use of an equivalent amount of less efficient capacity which has been pressed into service in the emergency would have saved a considerable amount of coal.

Coal Rate

Despite all of these obstacles, however, our coal rate today is only slightly more than 6 per cent higher than at the beginning of the war. This rate is not so low as we should like to have it, but it is still very good, and we are proud of it. It also, I might add, is lower than the national average.

To give you a better idea of this situation, let me present the facts in another way. If we had to get along in this war with the same level of generating station efficiency we maintained during the last war, 2½ times as much coal, involving four million additional tons annually, would be required to do the job being performed today.

Conservation of Material

As all of you know, coal is not the only commodity in short supply today. The war production effort of the nation places an unprecedented demand on many other materials which were also needed for the expansion of utility plant facilities. I need mention only copper, steel, and fabricated products requiring rubber. Industries with the highest priorities got most of these materials, and as a consequence, certain standards always considered basic by us ceased to exist, many months ago, so far as our business was concerned.

Throughout this emergency, we have used substitute materials wherever possible. Unless critical materials were essential for the bare production and delivery of power, we used something else. Many designs thus were altered, in some cases without affecting the services rendered and in others reducing standards to the necessities of a war-time level. New duplicate facilities were eliminated for the duration of the war. Iron wire was substituted for copper wire, where feasible. Copper wire and lead cable were salvaged and re-used wherever possible. System reinforcements, desirable and necessary under peace-time conditions, were reviewed carefully and postponed if they were not absolutely necessary for delivery of service for essential war loads.

The critical materials we did get were made to go as far as possible. For example, we cut the mileage of Company vehicles 40 per cent compared with the pre-Pearl Harbor mileage, thereby saving tires, gasoline, oil, and maintenance of equipment. We saved tons of paper by eliminating bill stuffers, advertising booklets, and various items of stationery. Precious office equipment was carefully nursed along, and we cut corners sufficiently to permit the release of nearly 100 typewriters to the government. Even the matter of out-of-town travel was carefully reviewed, and such trips restricted to absolute requirements.

The purchase and expediting of essential maintenance materials has been a matter of prime importance. Materials which were normally available in six weeks' time could not be delivered in less than six months. Heat-resisting chrome nickel steels were no longer available for industrial use. Many materials could be purchased only with priorities, and priorities and control plans changed overnight. Constant foresight was necessary to anticipate the needs and to have the material on hand, when required.

There is a bright side to almost every situation, however, and in this one we know that the lack of certain materials has not been without its compensation. Not only did we get along, but we actually found many desirable substitutes that will probably continue in use even after the war, when the need for strict conservation, as we know it today, is no longer necessary.

Quarterly Billing Plan

When the war started, the Philadelphia Electric Company had approximately 7400 employees. This total has since dropped to about 5800, the principal loss being to the armed services, which have taken about 1100. Other reductions reflect the curtailment of construction and sales activities.

This personnel deficiency has been overcome in many ways, not the least important being the loyal way in which the employees who remained on the job have doubled up and have put in overtime to keep abreast of the work we had to do.

Another way in which we helped ourselves was by changing certain refinements of service and operations in this war emergency. One example of this is the change made in meter reading and billing.

Each month we render about 800,000 bills. As a means of saving manpower, we developed the idea of reading meters and calculating the actual use of service only once in three months, instead of monthly as had been the practice. In the intervening two months, we rendered estimated bills based on each individual customer's record of previous use. The customer gets a bill each month, as before, and so far as he is concerned, there is little difference. For us, however, it has proved a worthwhile change.

Most important is the fact that the plan made possible the transfer of many employees to important jobs in other departments. Actually, we saved 225 full-time jobs. Some of the employees involved were lost to the armed services, and others left our employ for reasons of their own, but many of them were transferred to essential work in other departments.

We were delighted to find sufficient adaptability among the employees involved in these and other inter-depart-

mental transfers to permit their easy absorption in entirely new working environments. For instance, one month a man would be reading meters and the next month he would be perfectly at home on a job in a generating station.

Direct Contributions of Company Personnel

The "know-how" I mentioned before is not the exclusive property of any one department of the Philadelphia Electric Company. At the outbreak of the war, we had in our Sales Department a group of engineers who enjoyed long-established contacts with manufacturing companies in this territory. They had a thorough knowledge of the many applications of electricity and gas which could be used to accelerate war work; and they were also in touch with consulting engineers and research departments of large manufacturers interested in these matters.

The cooperation of these experts was immediately extended to the War Production Board, the Smaller War Plants Corporation, the Army Ordnance, the Army Air Corps, the Navy, and other governmental procurement agencies. Their subsequent services resulted in many cases in which their suggestions brought about increased production, greater efficiency, and safe operations.

Employees Lent to Government

The Philadelphia Electric Company's greatest contribution toward winning the war has been, of course, its nearly 1100 employees in the armed forces. They are making their presence felt in war zones all over the world.

In addition, we have lent the services of many of our highly qualified engineering specialists, on a full-time basis, to important governmental agencies, including the Army and Navy, for special work directly connected with the war.

Back in 1941, before this country entered the war, the Power Division of the OPM requested the services of K. M. Irwin, assistant to our vice-president in charge of engineering, and Constantine Bary, our rate research engineer, to help determine locations for plants to manufacture aluminum and magnesium. They worked on this problem for about two months.

Later, Mr. Bary was asked to tackle the job of analyzing and estimating the nation's power requirements for war. He took on this assignment in the summer of 1941 and from then until late in 1943 spent almost all of his time in Washington on this work. Even now he continues with the War Production Board in a consulting capacity.

C. C. Farrell, assistant electrical engineer of our Company, went to Washington late in 1941 to work with the WPB in a highly specialized activity and continued in this work until early this year.

H. A. Dambly, planning engineer from our Electrical Engineering Division, served as Chief of the WPB's turbine and gear section and as consultant on shipbuilding, from December, 1941, until last August.

Other P. E. employees have left their jobs and their homes in Philadelphia to accept important war assignments. Included are J. A. TenBrook, superintendent of construction of our Transportation and Distribution Department; and A. H. Kidder, R. E. Cross, and R. L. Davis, Jr., of our Engineering Department. The nature of their work must remain secret for the present, but we hope some mention of it can be made at a later date.

In addition, employees of this Company have accepted full-time assignments in essential war projects right here in Philadelphia. Included in this category are Carl A. zurNieden, of the Stores Department, who served as regional utility engineer of the WPB Utility Inventory Control Branch in Philadelphia for one year from April 1, 1943; Wilson Grant, of the T. & D. Department, who was associated with Mr. zurNieden virtually all of this time and who was also his successor, continuing with the WPB until September of this year; and L. J. Dougherty, our district manager at Frankford, who spent more than 18 months as staff director of the Philadelphia Office of Civilian Defense.

Time does not permit my commenting more fully on the importance of the work of these men, but I do want to explain the absence from July of this year until just a few days ago of a popular member of this club . . . "Kil" Irwin. His friends know about his earlier assignment I mentioned a minute ago, but his recent absence was a military secret for many weeks. I am free to tell you now, however, that he went to London to coordinate and expedite the rehabilitation of utility facilities in Belgium, Holland, and France.

Other War Jobs of Employees

No listing of P. E. employees who have or are doing essential war jobs outside of the Company would be complete without mention of the outstanding contribution of P. M. Alden, manager of our Retail Division, in local War Bond campaigns; of W. R. M. Very, of the Sales Department, in United War Fund work; and of our women employees in varying important projects. This latter group, all members of the Women's Committee of the P. E. Co.'s Employees' Association, have a very active Red Cross auxiliary; a knitting group which has completed thousands of knitted and sewed garments; a Grey Lady group, in which approximately sixty girls are working at least three hours a week at hospitals in Philadelphia and in the suburbs; and a surgical dressing group, averaging about 25 girls each week, which has completed thousands of vitally-needed surgical dressings. In addition, some of these girls serve at the Salvation Army's canteen in North Philadelphia. In another activity, they collected junk jewelry for service men to barter in the South Pacific. They collected hundreds of items of sports equipment for war prisoners. They spark-plugged a recent activity which produced improved lighting and decorations in the main recreation room at the Valley Forge General Hospital. All of these activities, each important in itself, add up to a most impressive record. Needless to say, the Philadelphia Electric Company is very proud of it.

Courtesy

There is yet another type of service we, as an organization, are rendering in this war emergency that I want to mention particularly, because it is so important. I refer to common courtesy in business dealings with customers.

It is exceptional these days to talk to anyone who is not represented in the armed services by someone near and dear to him. Few of us fail to notice the anxiety of even strangers we pass on the street. Tragedy on the battlefield is brought home to us every day. These are the things that are causing many Philadelphians to go about their daily work more than a little on edge.

Everyone in business today knows this condition exists, but not enough concerns have done something about it. In the Philadelphia Electric Company, with full appreciation of the fact that each of us on the home front has power to build morale simply by exercising common courtesy, we have gone out of our way to see that customers are treated with the kind of sympathetic consideration called for by these troublous times. There will always be the individual we simply cannot please . . . but, taking everything

into consideration, I believe I am pretty safe when I say that our employees are most successful in their efforts to build morale among our customers.

How well they succeed in individual cases is a matter that rests for the most part between our employees and our customers. Some customers, however, tell us what happens. It is, of course, always gratifying to get words of commendation, especially of the type represented by this letter:

"It is true that I have been slow in my payments. But you have been the most decent, patriotic business concern I deal with—you have been good to me. I'm sure my husband, who is in the Army, appreciates your cooperation as much as I do."

A sincere, unsolicited statement of this kind is most encouraging, because it just may be that we are strengthening morale on the battle line as well as on the home front.

Nowadays, rudeness is frequently glossed over with the excuse, "Don't you know there's a war on?" This is especially true when this bit of information has absolutely no bearing on the subject! I am sure we will long remember the places we get kind words, friendly smiles, and sympathetic understanding; and that we will also remember the indifference practiced in certain quarters today simply because the guilty ones can "get away with it."

In the Philadelphia Electric Company we are doing all we can to hold our place in the first classification—war or no war!

Goodwill

Throughout these strenuous times, we have devoted considerable display space —in our show windows and in our showrooms—to publicize various patriotic and civic causes. We have sponsored educational courses dealing with nutrition and food conservation. We have kept in touch with customers through newspaper advertisements which have featured the exploits of individual employees now in the armed services. From the very beginning, this advertising was popular. For two years in succession it won the top award for outstanding merit in a national contest. Another important compliment was a request from the Army for permission to use selected art work from the ads to further the Army's war bond program among our soldiers.

We have every reason to believe that the cumulative effect of these messages has been to win for us the favorable opinion of a goodly number of our customers, a compliment we are ever hopeful of holding.

Home Front Activities

No little part of whatever friendliness we have awakened in the communities we serve has been influenced by the support our employees give to civic and patriotic causes. In many instances they are found in key places, organizing teams, rallies, and other activities.

They have been especially generous in the purchase of war bonds, as well as in supporting the Red Cross, the United War Chest, and the Salvation Army. Blood donations have been given on regular schedules by hundreds of our employees, many of whom are members of the "Gallon Club." Others have taken a prominent part in scrap drives.

Of particular note is our Civilian Defense record. Eight days after Pearl Harbor saw the appointment of an emergency defense coordinator for the Philadelphia Electric Company. Of the approximately 7400 employees in our organization at that time, more than 90 per cent enrolled as volunteers and nearly 50 per cent received special training in defense technique. (The difference in these figures reflects the exemption of women employees from the training classes.)

Many have done much more work in these activities than any reasonable person would ever expect, in fact, some have given more than 2000 hours of their own time to Civilian Defense activities. When we stop to consider this is equivalent to fifty 40-hour weeks, or a year's work, there is no question about the measure of their support.

National Security Award

Naturally, we are proud of this record and of our earning the National Security Award, which is the highest ranking honor of the Office of Civilian Defense.

This recognition came to us—and I will quote from the certificate we received—"for extraordinary achievement in establishing superior security and protection measures against enemy air raids, fire, sabotage, and avoidable accidents."

Colonel Henry A. Reninger, acting regional director of OCD, in making the award on February 1, 1944, said that Philadelphia Electric employees "by voluntary enrollment and training as members of the United States Citizens Defense Corps have evidenced their patriotic zeal in the creation of an efficient organization for the total protection of (the Company's) facility. The award indicates," he continued, "a fine spirit of cooperation of management and employees, beyond the call of routine duty."

Safety

The importance of safety receives great emphasis in the Philadelphia Electric Company. Nothing is left undone that will help us eliminate accidents.

This program has paid rich dividends. So far this year, there has been no loss of life through accident; lost time accidents were close to the low level of 1943; and responsible automobile accidents decreased 14 per cent. During a 50-day period early in the fall, we had no lost-time accidents at all! This is the longest period in the history of the Company that our operations were free from mishap.

This record is particularly significant in view of the wide variety of occupations involved, including many jobs commonly considered extremely hazardous occupations. Our experience proves, however, that these jobs can be safe jobs!

This splendid record places the Philadelphia Electric Company high in city, state, and national safety contests, and it adds much to our own personal satisfaction, because it shows what can be done.

Taxes Up, Rates Down

It takes billions of dollars to win a war! All of us know this, in fact we take a personal part in the financial end of this war through war bond purchases and the payment of taxes.

The Philadelphia Electric Company knows it too, for it has been paying a very substantial tax bill each year. Actually, we are paying taxes at the rate of 20 cents out of every dollar we take in. (You may be interested to know that four cents of this twenty goes to state and local governments—to pay for schools, roads, police and fire protection —and that the remaining sixteen cents is turned over to the federal government.)

Despite this heavy tax bill, and the upward trend in the price of virtually everything that enters into the generation of power, electric rates have been kept down.

If you examine the cost of living figures, say from 1913 down to the present time, you will find that the price of food, clothing, rent, and house-furnishings sky-rocketed to unheard of peaks in 1920, then gradually went down, and are now climbing up again.

A notable exception to this general situation is the domestic rate for electricity. Ever since 1913 it has been going down and down, to the present all-time low. Today, these customers pay a price that is 70 per cent less than it was in 1913!

Suggestions

We consider ourselves most fortunate to have so many employees who are trying to find better ways to do things. This initiative is encouraged, and in every case where we get an idea that we consider worthwhile, the suggester is liberally awarded, with cash, for his interest.

This suggestion system has been productive of much good. It has been especially valuable during the war emergency. For example, so far this year, a total of 1500 suggestions have been received, approximately 31 per cent of which were considered worthy of an award, none of which was less than $5. A total of more than $7,800 has been paid out in the past year, the highest award being one for $530.

Big Job Well Done

The Philadelphia Electric Company, System, as it stands today, represents a well-maintained property in every respect, and the utmost in modern engineering design, safety, and construction. We have kept it that way during the war with no more than our share of available material and manpower. We have always made it a point to observe all rules designed to distribute critical materials equitably. We have played the game fairly and squarely, and have not asked for preference in obtaining materials, nor for the deferment of employees, except when conditions fully justified such appeals.

Future Expansion

Just as advance planning ten years ago enabled P. E. to meet the largest demand for electricity and gas on record without delaying a single war job, so will advance planning now under way provide the electricity and gas needed in the years of peace that lie ahead.

Perhaps the most important project in our plans for the future is the resumption of work at our Southwark Station, on the Delaware River near Oregon Avenue. Excavation for this project was started in 1941, but, as I said before, the work was stopped by the government in 1942. This postponement of the work for two years challenged our ingenuity to make up the deficiency. However, the critical material saved by our not building Southwark was diverted to the manufacture of bullets, and guns, and Navy propulsion equipment, and all of it was, without doubt, used in the right place!

Resumption of construction at Southwark was approved on September 12, of this year, the authorization permitting installation of 162,500 kw of capacity. Ultimately, it is planned to increase the capacity of this station to 650,000 kw.

We are going ahead with this project now, because our advance planning clearly indicates that it is the proper thing to do. Obviously, we have complete faith in the future progress and growth of the Philadelphia area.

Conclusion

Earlier this year, J. A. Krug, then director of the Office of War Utilities, and now chairman of the War Production Board, said, "No segment of our war economy can boast of a better job (than the electric power industry) . . . and at the same time, this achievement was accomplished with the minimum use of materials so necessary in the direct conduct of the war."

In conclusion, I should like to suggest the possibility that these accomplishments of the public utilities have slipped by unnoticed in many quarters, simply because they do not stand out so dramatically as the records of many major peace-time industries which had to be converted for war work.

Actually, public utilities met war peaks quietly and efficiently, with the same tools and facilities as before. We are happy we were able to keep up with the fast pace set and maintained by business generally.

The credit goes not to any one group —much less to any one individual. Every utility employee is entitled to some part . . . and in our Company he has it!

Hasbrouck Appointed EEI Accounting Director

H. C. HASBROUCK has been appointed to the newly-created position of Accounting Director of the Edison Electric Institute. His principal work will be in the co-ordination of activities of the several accounting committees of the Institute, and as consultant on accounting and regulatory matters. Graduating from Cornell University with the degree of AB, he was Assistant to the University Registrar for about four years and then became a member of the staff of the New York Public Service Commission for the Second District in its Division of Statistics and Accounts, later becoming Deputy Chief Accountant, in charge of the accounting and statistical work of the Albany Office of the Commission.

His work from 1921 to 1942 was chiefly that of a Consulting Accountant for the central management of the Associated Gas and Electric System, and he also served at various times as an officer or director of a number of System companies.

Mr. Hasbrouck has been active in association and committee work for 25 years. For several years he was Chairman of the Committee on Uniform Classification of Accounts both of the National Electric Light Association and the American Gas Association. More recently he was Chairman of the American Gas Association's Committee on Depreciation Accounting, which was organized primarily to work with the Depreciation Committee of the National Association of Railroad and Utilities Commissioners. He was also a member of the Edison Electric Institute's Depreciation Committee.

Mr. Hasbrouck is a Vice-President of The Technical Valuation Society, a professional organization made up of persons interested in engineering, accounting, and economic aspects of property valuation.

Fuel Costs Up—Electricity Costs Down

"THE cost of both gas and electricity to the typical household consumer was smaller in 1944 than at the outbreak of the war" states the U. S. Department of Labor in its review of the Cost of Living in 1944. (Monthly Labor Review, Feb. 1945, p. 395.) "Between September, 1939, and September, 1944, rates for both gas and electricity to domestic consumers declined about 3 per cent.

On the other hand, cost of fuels has shown large increases during this five-year period: bituminous coal has advanced in price by 21½ per cent, anthracite 32 per cent and fuel oil 33 per cent. The classification "fuel, electricity and ice," as a whole, has thus shown an increase of 12.2 per cent since mid-1939, entirely because of the rise in the cost of fuels.

Another Successful Accident Prevention Program

How We Do It

By H. H. Berman

Safety Engineer, Consolidated Gas Electric Light and Power Company of Baltimore

Presented at the Meeting of Edison Electric Institute Accident Prevention Committee, Cleveland, Feb. 8, 1945

THIS is another answer to the question: "How do you do it?" It is written at the request of the Edison Electric Institute Accident Prevention Committee that has decided to procure from certain members brief descriptions of the workings of safety programs in their respective companies.

The first reply to be published to the subject question appeared in the November, 1944, Edison Electric Institute BULLETIN and was excellently prepared by C. B. Boulet. In that article the methods employed in the successful accident prevention program of the Wisconsin Public Service Company were explained.

In the subsequent discussion of safety activities in the Consolidated Gas Electric Light and Power Company of Baltimore, we have concentrated on three main topics, namely, Investigation, Inspection and Interest.

Investigation

We consider the true facts concerning accidents to be of prime importance in our safety program.

In the instance of an employee injury case we endeavor to get the facts of the accident *promptly*. An injured employee is interviewed as soon as the attending physician will permit. In many cases an employee's account of the accident is reduced to writing in the form of a detailed statement for his signature. Included in the statement is information on the employee's length of service with the Company, experience in the occupation at which he was working when injured, family status and the name of his supervisor. Depending upon certain factors we may also include in his statement, *his* answer to the direct question: What do you think can be done to prevent a similar accident in the future?

Some employees place full responsibility for an occurrence on themselves. Realizing that safety work is fundamentally an education undertaking, we regard an employee who makes such an admission worthy of sympathetic treatment in a great majority of cases. Our procedure is to give him or her the benefit of our best advice. A sincere effort is made to impress the employee with the Company's attitude toward accidents and its intention to eliminate avoidable mishaps. Moreover we grasp the opportunity of explaining how the supervisor of the injured's employing department personally endorses and participates in the Company's accident prevent program. In this way we try to enlist a new recruit in the cause of safety.

It might be well to mention at this point that we have discarded the word *blame* from the Company's safety vocabulary. Instead, we use *responsible, responsibility, accountable, accountability*, or similar terms in referring to our findings and conclusions.

Thorough investigation frequently means making a visit to the location where the accident occurred. In certain cases photographs may be taken or sketches may be made. There may be a re-enacting of a particular accident (with full regard toward preventing one of the actors getting hurt).

A copy of the investigation file including the statement procured from the injured employee, statements by witnesses, together with other pertinent memoranda and information, is forwarded or delivered to the proper supervisor. After he has reviewed the file there is a complete discussion of the case.

Placing responsibility for a specific accident is not always a simple decision. Sometimes there are complicated developments. For example, the investigation may disclose that the injured employee was in no way accountable for the occurrence. The responsible individual may turn out to be an employee of another department. Under such circumstances the latter department's record is debited in the Safety Division's accident accounting system.

Employees are familiar with our system of conducting interviews following an accident and understand that a safety investigation has for its purpose the prevention of a recurrence and not the fixing of blame.

Inspection

In the electric business, inspections of various degrees and kinds are made on a round-the-clock schedule. Keeping a close watch on operations is a means of safeguarding against interruptions. In our Company we realize that an accident may result in a serious interference to operations, so safety inspections of conditions and employee practices are made.

We operate on the principle that individual departments are responsible for maintaining the safe condition of equipment and buildings and enforcing safe practices of employees.

Inspections conducted by the Safety Division serve as additional checks and are made in a spirit of friendly cooperativeness. We avoid any semblance of policing as we go about making safety inspections. Every effort is made to effect corrective action without delay. When on-the-spot action is necessary, our supervisors cooperate. When the indicated correction involves further study and planning, conferences are scheduled at an early date to consider all factors involved. The Safety Division has no authority beyond the power of recommendation. In our opinion this is as it should be.

As inferred above, our safety inspections are not "snooping" excursions into plants or around work locations. We think that these inspections should be conducted openly with supervisors and workers being aware of the Safety Division representative's presence. In the final analysis all employees are working for the same company. Does it not follow that employee relations should benefit from straightforward dealing in matters arising out of safety inspections as well as in matters arising out of other activities?

To us the most important accomplishment that can be realized from a safety inspection is the elimination of a hazardous condition or of a bad work prac-

tice. The credit for the accomplishment belongs to the operating department along with all the benefits which are derived from adopting the changes suggested by the safety representative who made the inspection.

We are of the opinion that safety inspections afford unusual opportunities to stop some accidents before they start to happen. Take as an example, the inspection of equipment on an overhead line truck. We would inspect it on work location in the field. Suppose we have found the rubber protective equipment in safe condition. However, we observe a "busted" wire-skinning knife in the rubber glove compartment of the truck. The knife handle is missing but the hooked blade is lying on the bottom of the compartment—rusty and to us, formidable. Do we yank out a black notebook and begin scribbling a condemning entry? We do not—and it may be added that you would not.

Under such circumstances, our procedure has been to ask the Foreman what he thinks of letting the crew see what we found. We wait until the members of the line crew can be assembled there on the spot beside the truck right where they can see the interior of the compartment. Then we stress the possible damage that might be caused by the discarded knife blade. In discovering the knife blade that lurked next to rubber gloves, we were afforded an appropriate opening to review the subject: care of rubber gloves. By such means are accidents prevented.

But to avoid any misinterpretations relative to our inspection methods, let it be said that we believe that our inspecting procedure conforms with the general pattern followed by most public utilities. In adhering to the regular pattern we strive to make our safety inspections serve their main purpose of providing an additional check on conditions and employee practices.

Interest

In our opinion, a safety program will not produce best possible results unless there is personnel interest in the program. With active interest on the part of personnel (and we use the word in its broad sense to include top management as well as other classes of employees) an accident-prevention program can move on to success.

In our Company we think that the methods used in our investigation and inspection procedures help to engender and sustain interest in the prevention of accidents, but we do not rely on these two activities to do the whole job.

Intra-company contests have proved effective indeed with us. A department that establishes a no-accident record for an extended period of time qualifies for a safety trophy. The employees of the qualifying department are assembled to receive a plaque which is presented by a member of top management. Under the terms of the company's safety contest, a winning department can receive additional honors by adding more no-accident years to its record. We give recognition to such achievements by making additional notations on the plaque.

Tied in with the company's safety contests is the annual Safety Barbecue and Oyster Feast scheduled for the eleventh time as of the current year, 1945. Groups with no lost-time accident experience for the preceding year earn the right to attend this celebration where informality is the keynote. We call a halt in the festivities only long enough to have a member of top management summon to the platform representatives of no-accident departments to receive official congratulations on the achievements of their respective groups. An exhibit sub-committee places on display special safety equipment and devices which are used by various company departments. The Safety Barbecue and Oyster Feast is a highly enjoyable celebration that has proved its worth as an interest-sustaining activity.

Like other companies we use posters in great numbers on our bulletin boards. Safety messages are another means which we employ to bring specific safety problems to the attention of the employees. Our program includes resuscitation training and first aid training for designated employees. Safety committees and safety conferences are important cogs in our program.

Under the terms of a Suggestion Plan, employees receive cash awards for ideas that are adopted. This activity has been in existence for more than fifteen years and yet in 1944, employees submitted upwards of 260 safety suggestions. Awards were made in 162 instances. Even when our deliberate study of an employee's safety suggestion leads us to the conclusion that we should not adopt the idea, we nevertheless strive to retain his interest. We don't want our decision to backlash and produce a discouraged or disgruntled employee, hence we try to handle the matter in suitable manner. In some instances the findings and conclusions are discussed in person with the suggester. In all cases the suggester receives written notification of the final disposition of the suggestion and the reasons for our decision. At the close of the letter we express the wish that if the suggester does not agree with the final action which has been taken, he or she should communicate with the Chairman of the Suggestion Committee. And suggesters have exercised this privilege of disagreeing with the disposition of one of their ideas. Furthermore, upon reopening the study we have found on occasions that the suggester has been correct in his contention. Naturally where we have overlooked or failed to arrive at the right disposition, we change our decision and notify the suggester accordingly. From the foregoing it can be gathered that we think a Suggester Plan is valuable in connection with arousing and maintaining employee interest in accident prevention.

What about top management interest? In our company there is no problem on this score.

Our safety program was formally announced and launched by the company President twenty years ago. Top management and department heads were called together specially to hear the details of the program, which at that time did not embrace the ramifications of the program as it operates today. One essential ingredient was very much in evidence, however. We'll call it cooperation. Our top management still cooperates and actively so.

We don't have passive managerial support in our safety activities. Whether an employee is in executive, supervisory or other capacity, we want and need and try to get that individual's active interest and aid in the prevention of accidents.

Conclusion

In this accounting we have briefly discussed some features of the safety program of the Consolidated Gas Electric Light and Power Company of Baltimore. The methods followed by this company have produced a modest degree of success in preventing accidents.

To summarize: we regard investigations and inspections as essential procedures in our search for necessary facts. Another vital consideration is keeping alive the interest of top management and other company personnel in the safety program.

These three I's—Investigation, Inspection and Interest—may be called the cornerstones on which our accident-prevention program is founded.

The Use of Infra-Red in Drying Pottery

By R. E. Gould, B. B. Evans and A. M. Flannigan

Executive Vice President, Plant Manager and Laboratory Technician, respectively, of Buffalo Pottery Co.

Reprinted Courtesy of Bulletin of the American Ceramic Society

FROM 90 to 150 minutes may be considered as the minimum time for forced drying hotel china flatware. This is usually done in continuous or periodic dryers using hot air as the heating medium.

If this type of drying were to be used in connection with an automatic jiggering machine, with a production of 80 to 100 dozen per hour, then 150 or 200 dozen moulds would be required for any given item. The usual life cycle of a plaster mould is about 200 fillings before the mould is worn out. Therefore, approximately 35,000 dozen of the item being made would be theoretically manufactured. This amount far exceeds the practical limit which can be sold in a reasonable period, and the time alone required to make this quantity would be excessive and would badly unbalance even the largest bisque stock.

The unpleasant alternate is frequent mould and machine changes, where, in a small shop, the profit from labor saving on the machine would possibly be entirely consumed, especially if the line to be made on the automatic machine were to be expanded to include from 30 to 50 items, or better, all of those shapes which have a minimum sale of 1000 or 2000 dozen per year. The storage space required for this number of moulds alone would be quite formidable.

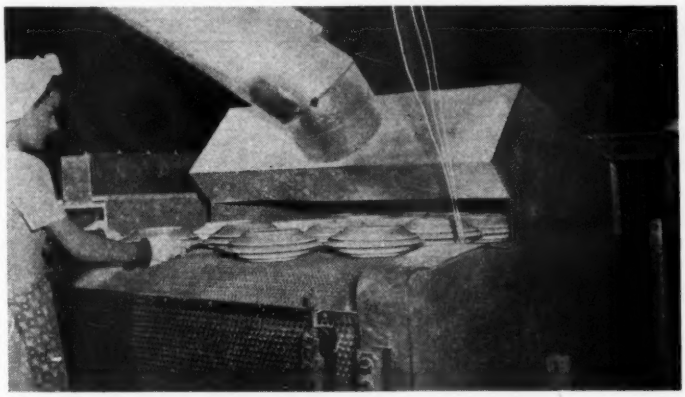


Fig. 2—Loading end of drier.

The war with its attendant labor difficulties forced the Buffalo Pottery to reconsider former adverse calculations in respect to the automatic jigger, and it appeared that the machine could be made to work successfully provided a dryer could be found which would reduce the time required, from an average of 120 to 15 minutes. If this were possible, the number of moulds required for any item would be reduced from 150 or 200 dozen to approximately 25 dozen. Also, the amount of ware of any given item for a complete cycle of the moulds would be about 5000 dozen, or if this amount were not required, the *storage space* of this number of moulds *would not be excessive.*

A survey of the conventional types of dryers indicated that they would not safely fit the above specifications, and that infra-red heating, because of the phenomenal results obtained in other fields, perhaps stood the only chance of being successful.

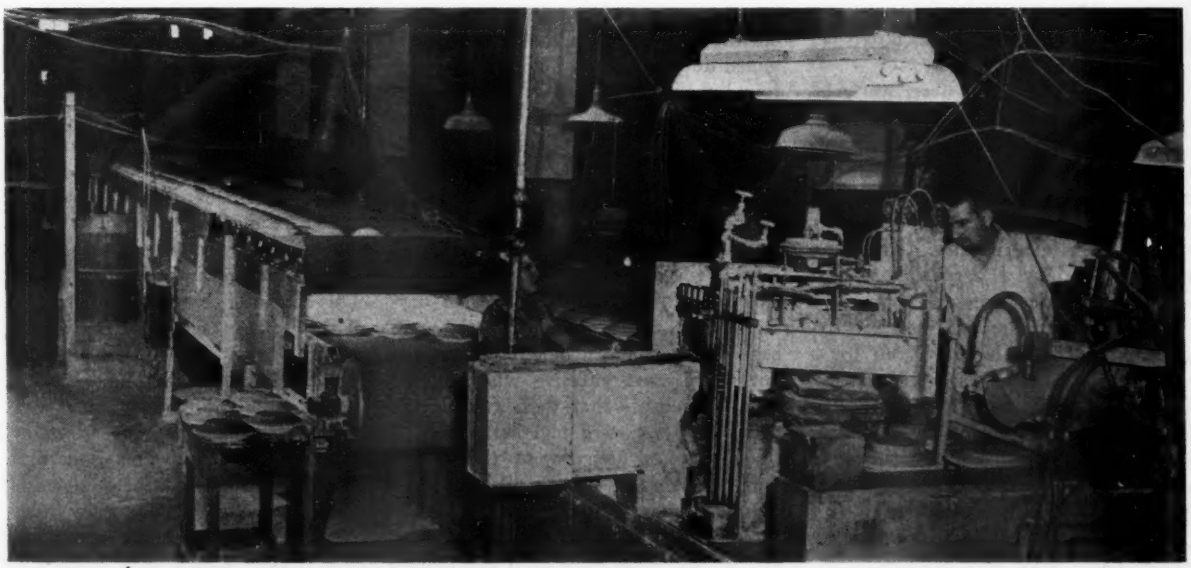


Fig. 1—Automatic jigger and infra-red drier.

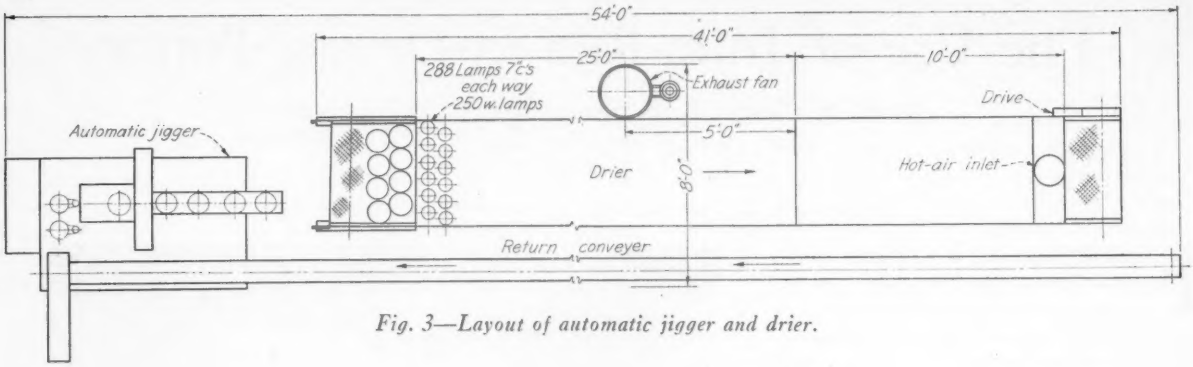


Fig. 3—Layout of automatic jigger and drier.

Fig. 4—Test specimens of bodies with thermometers inserted.

Laboratory experiments using clay specimens as well as hand-jiggered pieces, indicated that ware could be dried within the time limit required, and these experiments were gradually increased in scope until a continuous machine capable of drying the production of a hand jigger, or about 25 dozen per hour, was developed.

The success of this last dryer was good enough to risk the construction of a continuous electric infra-red machine capable of taking the production of the automatic jigger. This dryer was constructed and so placed that it could be eventually made into an integral part of the automatic jigger. Figs. 1, 2 and 3 show layouts of automatic jigger and dryer.

Results to date are extremely gratifying, and the dryer has now run for a number of months so that it is now possible to say that rapid drying can be done using infra-red lamps as the major heat source and with a mould turn-over on average hotel china flatware of from three to four times per hour.

During this time, the following interesting results have been obtained:

(1) From 12 to 15 minutes are all that is necessary to dry the average hotel china plate to a hard enough state so that it can be removed from the mould without fear of distortion.

(2) There is little evidence that the moulds become saturated after continuous use, and the ware, after a 16-hour operation is as dry as that which is obtained during the first hour. It has been found possible to increase the density of the plaster mixture to the maximum.

(3) The automatic jiggering machine which has an average capacity of 85 to 90 dozen per hour requires only 25 to 30 dozen moulds for a complete component on any one item.

(4) The infra-red appears to be most effective during the first stages of drying; i.e., up to the point where the ware has released from the mould. After this, hot air is more effective which would seem to indicate that these two drying agents are best used together.

(5) It has been found that pieces will crack in the dryer which have an unsound internal structure; i.e., some foreign matter such as wood, plaster, dirt, or air blebs present in the middle of the piece. This is considered a practical advantage, as the number of defective pieces from the bisque fire is reduced.

(6) It has been observed that the making of flat ware must be done as carefully as by hand. Faults tending to cause drying cracks cannot be corrected by infra-red.

(7) No apparent difference has been observed between the drying of pieces with a large amount of surface moisture and those which are jiggered rather dry. The same has been observed in respect to the use of "hard" and "soft" clay.

(8) It appears that results are better than with the conventional methods of hot air drying in respect to warpage. This may be due to the even application of the heat, or may be traceable to the machine operation which is more consistent than that done by hand.

(9) Results indicate that the color of the clay has a marked effect on the rapidity of drying. This is natural, as it is known that the heat ray is absorbed by dark colors and reflected by light. It, therefore, appears to be practical to add dark colored aniline dyes to the clay in order to take advantage of this feature.

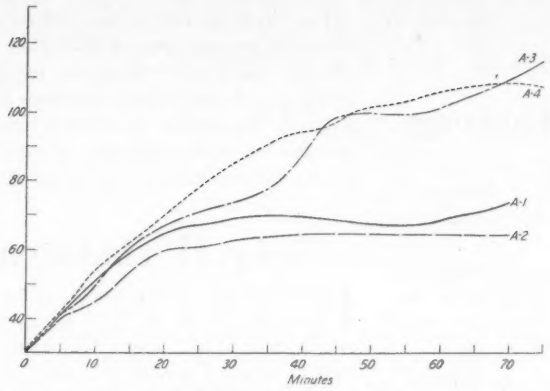


Fig. 5—One-inch thick specimen 1½ inches from lamp. Curves: A-1, plain white body; A-2, white body, white surface; A-3, white body, black surface; A-4, black body

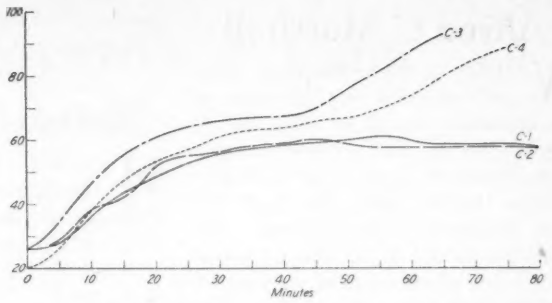


Fig. 6—One-inch thick specimen 3½ inches from lamp. Curves: C-1, plain white body; C-2, white body, white surface; C-3, white body, black surface; C-4, black body

(10) At Buffalo rates power costs obtained so far range from 34/100 to 45/100 of a cent per dozen plates. In view of the good results obtained and the flexibility of the machine in making a large number of items, this cost appears to be within reason. There is the additional fact that the power factor is aided because of the low reactive kva of the infra-red lamps. These costs do not contain the other items such as lamp expense, depreciation, repair, etc., which appear, at the present time, to be very nominal.

Various laboratory experiments were run to determine the reasons for the successful rapid drying which was being done. For example, it was thought desirable to determine the rate of heat penetration into the clay, and whether or not there was an actual heating effect from the inside out, due to this method of heat application, or if this were a case of surface absorption only. Furthermore, the difference in drying of different colored bodies was quite apparent in the production unit and appeared to merit some further study.

Two test specimens were used, as shown in Fig. No. 4. The heat in the bottom part of these specimens was measured at 5-minute intervals when placed under a 250 Watt infra-red lamp using two distances from the heat source, i.e., 1½ in. and 3½ in. Specimens were made to test the effect of four colors, as follows:

(1) The regular body with sufficient lamp-black added to make it visibly black.

(2) The regular body with a thin coating of lamp-black applied to the surface.

(3) The regular body with a thin coating of white precipitated magnesium-oxide on the surface.

(4) The regular body without the addition of colorant or any coating. The results are shown in Figs. No. 5 through No. 8.

A study of the heating-up curves appears to indicate that color plays an important role, not only in the heating-up to equilibrium, but also in the final temperature obtained. It would, therefore, appear that the efficiency of the dryer could be increased taking advantage of this fact.

It further appears that the temperature of the clay is caused by the surface absorption of the heat ray, and there is little evidence of ray penetration. To check this, however, various tests were made by placing a high speed sensitive film underneath ¼ in. thick test specimens of plastic clay and exposing the test pieces to the infra-red lamp for periods of 3 to 15 minutes. The developed films gave no indication whatsoever of exposure. These data were not absolutely conclusive, however, and it might well be that with other types of lamps there could be definite ray penetration.

In conclusion, it appears that rapid drying of clay ware can be successfully accomplished by means of infra-red heating. The undeniable advantages of a high mould turnover; a large saving in factory space, and the development of a piece of machinery which can readily lend itself to automatic operation, should prove that this type of apparatus is worthy of future consideration in similar installations.

The authors acknowledge with sincere thanks the kind help given them by Quermback Electric, Inc., and Mr. R. B. Benz of Buffalo Niagara Electric Corporation in the development of this installation and the writing of this paper.

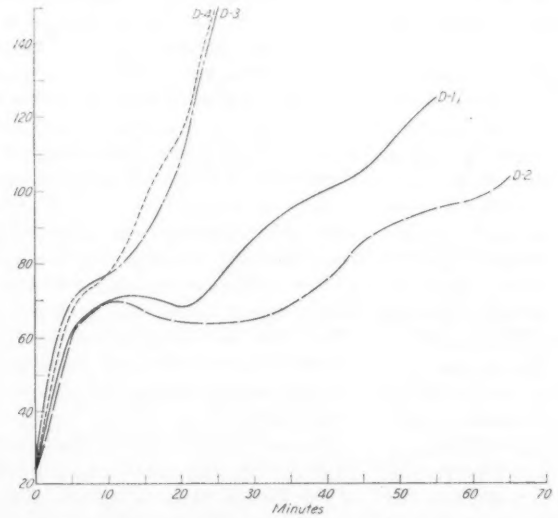


Fig. 7—One-fourth-inch thick specimen 1½ inches from lamp. Curves: D-1, plain white body; D-2, white body, white surface; D-3, white body, black surface; D-4, black body

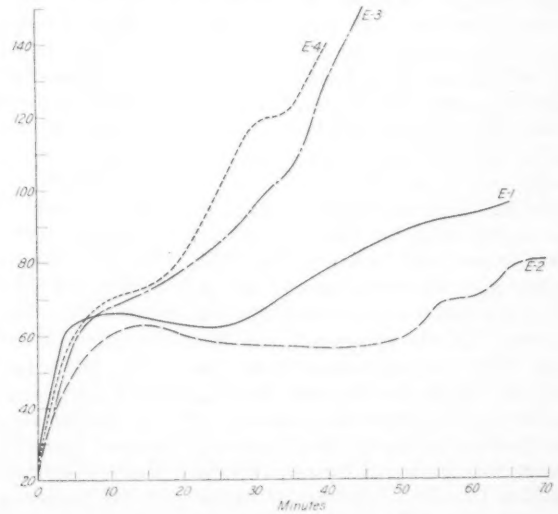


Fig. 8—One-fourth-inch thick specimen 3½ inches from lamp. Curves: E-1, plain white body; E-2, white body, white surface; E-3, white body, black surface; E-4, black body

Alfred C. Marshall

ALFRED C. MARSHALL, director, consultant and chairman of the operating council of The Detroit Edison Company and a former member of the Board of Trustees of the Edison Electric Institute, died Feb. 9, at Detroit, following a short illness. His death was caused by an injury received from a fall which occurred on Jan. 28. Mr. Marshall had retired in May, 1944, as president of Detroit Edison, a position he had held since 1940.

He was born in Middletown, Ohio, Sept. 26, 1872. He was educated in the Detroit public schools and graduated from the University of Michigan in 1893 with a Bachelor of Science degree in Electrical Engineering. In 1932, the University of Michigan conferred upon him the honorary degree of Master of Science in Engineering. Wayne University honored him in 1943 with a degree of Doctor of Arts in Business Administration.

Mr. Marshall was first employed by the Public Lighting Commission of the City of Detroit from 1894 to 1899. In 1899, he became Chief Engineer of the Rapid Railway System and left this organization in 1904 to become an engineer on construction work for The Detroit Edison Company. He was appointed General Manager of the Port Huron Light and Power Company in 1905, and in 1911, he was elected Assistant to the President of the Eastern Michigan Edison Company. He became a Vice-President of The Detroit Edison Company in 1913, and in 1923 was made General Manager. In 1940, he became President and General Manager. From March 16, 1943, to May 16, 1944, he served as President and retired from this position on May 16, 1944. Mr. Marshall had been a Director of The Detroit Edison Company continuously since 1920.

He had held many official positions and memberships in Detroit and national engineering, industrial, and civic organizations. For many years he was active in the affairs of the Edison Electric Institute and its predecessor the National Electric Light Association. He was a Fellow in the American Institute of Electrical Engineers and a member of the American Society of Civil Engineers, Engineering Society of Detroit, Alumni Advisory Council, University of Michigan; Michigan Electric Light Association, executive committee, Association of Edison Illuminating Companies; and a member of United States Chamber of Commerce.

Harvey M. Cushing

HARVEY MORSE CUSHING for 22 years Chief Mechanical Engineer for Buffalo Niagara Electric Corporation, and one of the nation's authorities on steam power generation, died Jan. 31, 1945, at his home in Buffalo, N. Y., after an illness of several months. He was 69 years of age.

Mr. Cushing was born in Rockford, Ind., Dec. 5, 1875. He was a graduate of Massachusetts Institute of Technology in 1899 with a degree of Electrical Engineer. Upon leaving M.I.T. he had charge of the installation and operation of the 100 kw dynamo, motor and lighting equipment in the Janney Manufacturing Company's new factory at Ottumwa, Iowa. In January, 1900, he began as a tester in the Dynamo and Motor Department of the Western Electric Company, Chicago plant, and 6 months later joined the General Electric Company, remaining in various capacities, until December, 1914.

Mr. Cushing had been associated with Buffalo Niagara Electric and predecessor companies since 1915 when he joined the Buffalo General Electric Company as Chief Mechanical Engineer. During the first 6 years of his service with the company, he supervised the inside electrical construction in all substations and all engineering—both electrical and mechanical—of the Charles R. Huntley Steam Stations at Buffalo.

Upon his appointment as chief engineer Jan. 1, 1922, Mr. Cushing was in complete charge of all electrical, mechanical and structural designing, drafting and construction for the company. While serving in this capacity, several new substations, an addition to the main office building and other miscellaneous structures were designed and erected. He also directed the engineering and construction involved in increasing the generating capacity of Huntley Stations during the period from 1925 to 1932.

In 1933 he had supervision over steam-electric-generating station-design for the Niagara Hudson System and associated companies, designed the Oswego Steam Plant and supervised construction of the steam generating facilities at Schenectady. Since 1941, he had been a Consulting Engineer for Buffalo Niagara Electric Corporation.

He was a member of the Buffalo Engineering Society; American Society for Testing Materials; American Institute of Electrical Engineers; American Society of Mechanical Engineers; and a member of Prime Movers Committee of the Edison Electric Institute.

Philip H. Gadsden

PHILIP H. GADSDEN, who retired on Jan. 1, 1942, as senior vice-president of The United Gas Improvement Co. of Philadelphia, died in his 78th year at his home in Philadelphia on Feb. 27. Mr. Gadsden was a former trustee of the Edison Electric Institute. His career as a public utilities executive spanned a period of more than forty years. He began it in 1900 as vice-president of the Consolidated Railway and Lighting Co., of Charleston, S. C., becoming president of that company in 1903.

He was vice-president of the Charleston Light and Water Company from 1907 to 1917 and a member of the Federal Electric Railways Commission in 1919. During the World War he was chairman of the war board of the American Electric Railway Association and chairman of the National Committee on Public Utility Conditions.

Mr. Gadsden was also chief of the Philadelphia District Ordnance Office of the War Department during the first World War. He was president of the American Electric Railway Association in 1921, president of the Southern Gas Association in 1922 and president of the Eastern States Gas Conference in 1923. He became vice-president of the United Gas Improvement Company in 1919, remaining with that organization until his retirement in 1942. For several years in the '30's he spent much time in Washington as chairman of the Committee of Utility Executives.

Born in Charleston, S. C., Oct. 4, 1867, Mr. Gadsden was a graduate of the University of South Carolina in the Class of '88 and received a Doctor of Laws degree from the university in 1918. He was admitted to the South Carolina bar in 1890 and served in the South Carolina House of Representatives from 1893 to 1898.

He was a director of the Fidelity Mutual Life Insurance Co., a director of the United States Chamber of Commerce from 1921 to 1929 and president of the Philadelphia Chamber of Commerce from 1921 to 1929.

Factors Which Influence Aerial Cable Design and Operation

By Robert J. Wiseman
Chief Engineer, The Okonite Company

Presented before the Transmission and Distribution Committee, EEI, at Pittsburgh, Pa., Feb. 16, 1945

THE transmission of power by aerial open wire circuits is the oldest and most widely used means throughout the country as it is the most economical method, and when properly constructed and protected, requires a minimum of maintenance. There are times, however, when an insulated cable is preferred and it becomes necessary to choose the kind of cable best suited for the service. Naturally, the three major insulations—impregnated paper, varnished cambric and rubber have been used. For the low voltage range rubber predominates with impregnated paper taking first place for 15 kv and over. Varnished cambric cables have been used for all voltages up to 15 kv and in a few cases higher voltages.

The selection of the kind of insulation to use for aerial cables requires consideration be given to several factors, such as range of ambient temperature, operating temperature, weight and diameter of the cable, ease of installation, span length and sag allowable, vibration effects, weather resistant properties and maintenance.

The range of ambient temperatures may, in some sections of the country, be an important factor, particularly the lowest values, as in the case of paper cables with no load or lightly loaded where the contraction of the oil may result in high vacuum and ionization, which in time, may cause failure. This condition is intensified, if during the Summer period, very high ambient temperatures are experienced, which with the temperature rise due to the load, will cause very high internal pressures and sheath stretching, if not splitting. Then when the cable is cold again, the vacuum-ionization effects take place. Some of this effect can be overcome by the low gas pressure cable which eliminates the oil expansion effects and prevents a vacuum occurring by a constantly applied gas pressure.

The range of ambient temperature is not important to either rubber or varnished cambric cables except that the difference between the highest temperature and the ambient temperature will give the temperature range and thereby influence the conductor size.

Although impregnated paper cables have the highest operating temperature with varnished cambric next and then rubber, they also have the highest thermal resistance, again varnished cambric next and then rubber. This means for a given voltage and load it usually happens that the conductor size will be closely the same for all those kinds of insulation. However, impregnated paper cables have the lowest insulation thickness, again varnished cambric and then rubber. This means that up to the covering over the insulation, paper cables will have the smallest diameter, then varnished cambric and rubber. If a three-conductor cable is selected, it is possible to use sector shaped conductors for paper cables which will further reduce its diameter. There have been a few varnished cambric cables made with sector shaped conductors but it is not usual practice.

Impregnated paper cable usually will have a lead sheath covering, although there have been installations where a reinforced rubber jacket has been used in order to eliminate the use of lead. However, when a rubber jacket is used there is the possibility of moisture getting through in time and perhaps failure; also the internal pressure due to the oil and the possibility of the oil affecting the rubber could cause the jacket to fail. Varnished cambric cables also should have a lead sheath although a rubber jacket has been widely used and with less chance of failure than in the case of a paper cable. Rubber cables can be installed without a lead sheath and may or may not have a braid covering.

The use of a lead sheath on aerial cables introduces several disadvantages. Due to its density, it adds considerably to the weight of the cable. As it is only slightly elastic, internal pressures can easily cause stretching. If oil is fed from reservoirs at joints along the lines, it may cause ratcheting and split sheaths. If solid filled joints are used, as stated previously, it will result in vacuum on no load and voids in the insulation, intensified in the Winter time and weakening of the insulation. Probably the greatest shortcoming of lead sheaths is failure by intercrystalline fracture. This is caused by vibration and also by the working of the lead due to temperature changes resulting in lead fatigue. We consider cable movement as a major problem in manholes. We must also consider cable movement on aerial lines as important. We have points of loops or sags along the line. As the cable heats and cools the lead is stretched and then contracted, ripples or wrinkles will form and in time, the lead splits. For aerial lines, alloyed lead sheaths will stand up better than straight commercial lead, but there is still room for improvement and both cable manufacturers and utility engineers are now studying this problem. There are certain similarities between lead sheathed cables operating in ducts and manholes, and in the air. We are not yet sure that the same kind of lead sheath is good for both.

The standard is to use either 2 per cent tin or ¾ per cent antimony in lead sheaths for aerial cables. As tin is not available at present, antimonial sheaths are furnished. Up to about 20 years ago it was customary to use 3 per cent tin or 1 per cent antimony. It was believed at the time that equally good results were obtainable with the reduced contents and at the same time they were easier to run on the lead press. We are not so sure today that the reduction was correct to do. I understand our telephone friends like 1 per cent antimony. Their problem is fairly similar to ours as they have cable movement due to daily change in temperature from the heat of the sun and get failures like ours for aerial cables.

The diameter and weight of the cable

are important as they influence the size of the messenger to carry the cable, which is also dependent upon the span between poles, the allowable sag of the cable and the wind and ice loading. For design purposes we take a 100 foot span and 18 inch sag with the following wind and ice loading depending upon the geographical location as given in A.S.A. Standard C-22-1941 "Safety Rules the Installation and Maintenance of Electric Supply and Communication Lines":

Loading District	Heavy	Medium	Light
Radial Thickness of Ice	1/2"	1/4"	0
Horizontal Wind Pressure	4 lb./Sq.Ft.	4 lb./Sq.Ft.	9 lb./Sq.Ft.
Temperature	0° F.	15° F.	30° F.

Table I gives a comparison of the diameter, weight of cable and size of messenger we would recommend for the three kinds of insulation for 4.15 kv operation to carry 1500 kva load and also for 13.8 kv operation to carry 5000 kva load in each district. A factor of safety of 2 is normally used in determining the size of messenger. There is quite a spread in the breaking strength of the messenger which accounts for the use of the same size for the paper and varnished cambric cables. Also, the reduction of 1/16 in. only for a rubber cable is due to that being the next size messenger and results in a higher factor of safety than 2, more nearly 3.

Although we have manufactured lead sheathed aerial cables, we have felt for some time that a non-leaded, rubber-insulated cable has advantages which are worth consideration. As indicated in Table I, the weight of the cable is less, the possibility of lead troubles eliminated and the size of messenger is less. However, the elimination of lead sheath and the use of braids on rubber insulated cables introduced other undesirable features. We are all acquainted with the unsightly appearance after a few years of braided aerial cables. The deterioration of the braid comes from two sources, the natural rotting due to weathering of the braid and also the rotting due to the flow of the charging current over the braid to grounding points. This discharge or drainage current may result in sparking and ionization of the air with the formation of ozone and also ionized nitrogen. The latter, in the presence of moisture, will form nitrous acids, which in turn, will attack the braid. With the destruction of the braid, the insulation is exposed and if it is not a corona resistant type insulation, quick attack by ozone and in time failure. For voltages up to about 2 kv this condition is not very serious but increases in its effects as the voltage increases. This means that it becomes necessary to use a ground shield over the insulation. The drainage of the charging current is taken care of but the deterioration of the braid from natural rotting still exists. Although this is a solution of the problem with respect to the protection of the insulation, we feel that it is expensive for moderate voltages and if a non-metallic, non-fibrous sheath could be found, we would be nearer the true design of an aerial cable.

When we were first studying Neoprene and its electrical characteristics as a possible insulating material, we noted its extremely high surface leakage resistance. As the problem of aerial nonmetallic shielded cable is one of leakage current flow, it was suggested that a comparison of the surface leakage resistance of braids and Neoprene be made. (Okoprene is the compound we use and which contains about 60 per cent Neoprene. There is no rubber in the compound.)

After determining the values of surface resistivity for braids and Okoprene, both wet and dry, the amount of surface discharge current was calculated for different distances between grounding points, using standard transmission line formulae. They could not be measured because of the low magnitude of currents involved. However, similar curves have been actually measured with lower surface resistances and longer lengths and found to check the calculated curves.

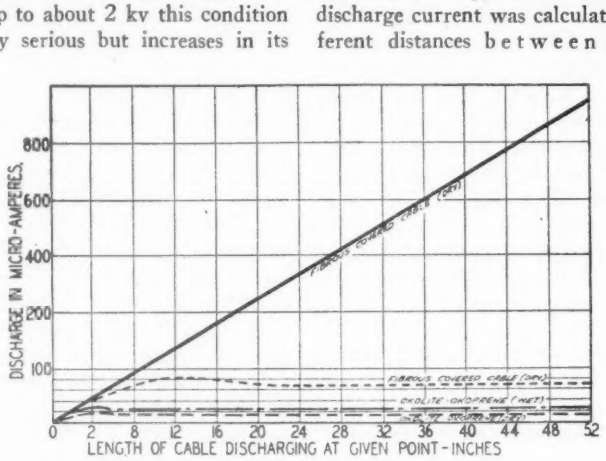


Fig. 1—Comparative Values of Charging Current Drain.

Fig. 1 shows the calculated values of discharge current for the dry and wet conditions. The top curve is for a braided cable under wet conditions. The second curve is for the same cable with a dry braid. The surface resistance of the wet braid is about 50 megohms per inch and for the dry braid about 20,000 megohms per inch. The dry braid is satisfactory from a discharge viewpoint, but braids take up moisture so this desirable condition will only exist in a dry hot atmosphere. The two bottom curves are for the Okoprene covered cables. The currents are about one-third of the dry braid and almost the same for the wet and dry condition be-

TABLE I—CONSTRUCTION OF AERIAL CABLES

Insulation	*Condr. Size*	*Diam. of Cable (Ins.)*	*Weight of Cable (Lb. per Foot)*	*Size of Steel Messenger (Ins.) Loading District* *Heavy*	*Medium*	*Light*
			5 kv. Rating			
Paper	3/0	1.56	4.5	7/16	7/16	3/8
Var. Cam.	3/0	1.80	5.2	7/16	7/16	3/8
Rubber	3/0	1.95	2.4	3/8	3/8	5/16
			15 kv. Rating			
Paper	3/0	1.97	6.2	1/2	7/16	7/16
Var. Cam.	3/0	2.46	7.5	1/2	1/2	7/16
Rubber	3/0	2.72	4.3	7/16	7/16	3/8

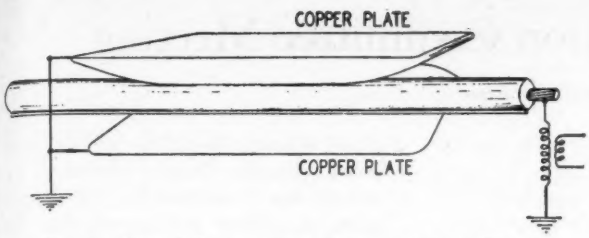


Fig. 2—Visual Corona Test Between Metal Plates.

cause the surface resistance is closely the same: 200,000 megohms per inch for wet surface and 250,000 megohms per inch for a dry surface.

The replacing of a braid covering on a rubber insulated cable with Okoprene removes the weathering shortcoming of a braid. Question arose as to the possibility of corona discharge where the surface was in partial contact with a ground injuring the Okoprene as will happen to non-corona resistant insulation. If the voltage at which corona appears is close to the operating voltage, there is a chance at points along the line that it would occur.

Tests were made to determine the voltage at which corona would occur on both braid covered and Okoprene covered cables both wet and dry. These tests were made with the sample placed between two flat plates which are grounded, as shown in Fig. 2. Voltage was applied to the conductor of the cable and the voltage at which corona appeared and disappeared noted. The results are given in Table II.

The Okoprene covered cables require a higher voltage to cause corona and there is only a moderate drop in voltage for a wet surface as compared to a dry surface. For a braid covering the wet surface causes a drop of 50-70 per cent in the voltage to cause corona from that for a dry surface. In the case of braided cables this corona voltage can be lower than the operating voltage.

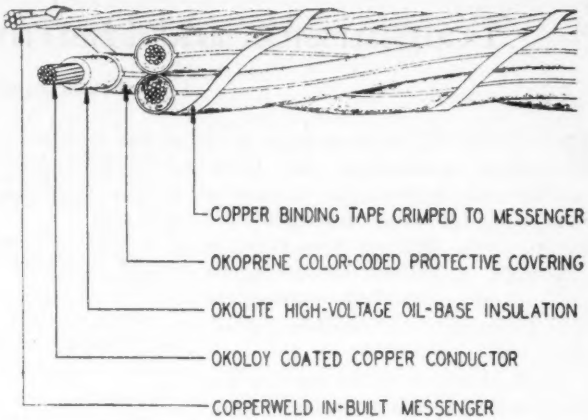

COPPER BINDING TAPE CRIMPED TO MESSENGER
OKOPRENE COLOR-CODED PROTECTIVE COVERING
OKOLITE HIGH-VOLTAGE OIL-BASE INSULATION
OKOLOY COATED COPPER CONDUCTOR
COPPERWELD IN-BUILT MESSENGER

Fig. 3—Okolite-Okoprene Self-Supporting Cable With In-Built Messenger.

These results indicated that a rubber insulated cable with an Okoprene covering over the insulation should have a longer life in service than a braid covered cable. To prove that this is so, cables with both kinds of covering were installed in our Proving Grounds and 7500 volts applied between the conductors on a 4150 volt design. The braid covered cables show evidences of the braid rotting away in five years and we found the braid burnt away under the cable ring with corona cutting having started, while the Okoprene covering after five years shows no signs of any weathering or electrical damage. Until further experience is obtained, we are limiting the operating voltage to 5 kv for these Okoprene covered cables.

We prefer the use of three single-conductor cables, twisted together, for aerial use if there is to be a transmission of three phase power with the Okoprene covering over each cable. However, if a customer desires, we will furnish Okoprene jacket overall or a braid overall. This adds to the cost of the cable without any additional benefits.

As aerial circuits are operated at higher voltages than 5 kv, either of two designs are possible, a metal shielding tape over the insulation on each conductor with an Okoprene covering or a braid, although the former is preferred because of its longer life, or a conducting Okoprene covering directly over the insulation. This conducting Okoprene is not the equivalent in conductivity to a metal shielding tape, but as the cables are in contact very frequently and in short distances, the surface resistance is very low and the charging current will not cause a voltage to be built up on the surface. For the present we are limiting the operating voltage to 15 kv. For higher voltages, the metallic shielded cable would be used and either the Okoprene covering over the shielding or a braid. When the conducting Okoprene is used, it is necessary to consider it as a shielding when making splices and terminations.

During the last five years interest has been taken in improving the methods for installing aerial cables. The customary practice is to string the messenger, the application of the cable rings, pulling in of the cable and then riding the messenger to properly space the cable rings. This has held the cable lengths to not much over 750 ft. The wearing of the cable at the rings is well known both from movement as well as spark discharging due to poor contacting. We are all acquainted with the telephone company practice of a machine which is drawn along the messenger which binds the cable and messenger together with a metal binder. This same idea can be introduced into power cables, only in this case they are bound together at the

(*Continued on page* 84)

TABLE II—VISUAL CORONA: FIBROUS VS. OKOPRENE-SHEATHED CABLES

Insulated for 5 Kv, 3 Phase-Volts to Ground

	No. 1 AWG Fibrous Covered (Volts)	*No. 1 AWG Okoprene Sheath (Volts)*	*350,000 CM Okoprene Sheath (Volts)*	*4/0 AWG Fibrous Covered (Volts)*
Cables Tested Dry				
Corona Discharge Appeared	3300	4600	5000	4300
Corona Discharge Disappeared	2800	4100	4200	2800
Equivalent Phase Voltage	5720-4850	7970-7110	8660-7270	7450-4850
After 24 Hours Immersion				
Corona Discharge Appeared	1800	4400	4800	1300
Corona Discharge Disappeared	1000	4000	3900	850
Equivalent Phase Voltage	2130-1730	7630-6930	8310-6750	2250-1470

Transmission and Distribution Committee Meeting

Frank Sanford, *Chairman*

RESTRICTED in attendance to its official membership, the Transmission and Distribution Committee held its regular winter meeting Feb. 15 and 16 at the William Penn Hotel in Pittsburgh. Invitations to our regular guest list were cancelled following the O.D.T. request for travelling curtailment.

A special feature of this meeting was the presentation of four papers by members of the T & D Committee of the Pennsylvania Electric Association whose meeting was held concurrently. Two of these reports were on subjects investigated by the Pennsylvania Electric Association committee and suggested for further handling by Edison Electric Institute on a national basis.

The first of these papers was presented by Mr. W. R. Wilbur, Metropolitan Edison Company, and covered simplification of design of line hardware used in rural construction, and the possibility of reducing the number of items at present manufactured for this purpose.

The second paper was by Mr. J. W. Anderson, Philadelphia Electric Company, on fractional horsepower household units and distribution system problems that may be expected to arise if post-war volume sales of such equipment as domestic air conditioning and deep freeze units materialize in the different types of load indicated by present trends. Questions of design and problems associated with the choice of motors were discussed by Mr. J. H. Joyce, General Electric Company.

Mr. J. G. Charest of the Pennsylvania Power & Light Company reported on the results of a Distribution Transformer Fuse Rating Study. New type fuse links for improved operation were described and discussed by Mr. E. H. Yonkers, Joslyn Manufacturing & Supply Company, and by Mr. G. F. Lincks, General Electric Company.

Mr. E. H. Kendall, Chairman of the Line Hardware Subcommittee, reported on the status of the following eight active specification projects now in progress:

1. Pole Steps (TD-15)
2. Steel Clevises for Guy Strain Insulators (TD-21)
3. Pole Guards (TD-12)
4. Lightning Arrester and Cutout Brackets (TD-19 and TD-20)
5. Steel Insulator Pins (TD-17)
6. Staples (TD-14)
7. Secondary Racks
8. Guy Hooks and Guy Plates (TD-11 and TD-16)

The first three of these specifications are nearing final draft form and considerable work has been done on most of the others.

Mr. V. E. Hill, Electrical Planning Engineer, Duquesne Light Company, described his method of recording and analyzing customer service interruptions so as to be able to determine what the actual interruption experience is for various classes of customers, and what means can be justified from an economic point of view to improve service continuity.

A report covering the operating experience of nine companies using Automatic Reclosing Line Sectionalizing Devices was made by Mr. K. H. Ishler, Pennsylvania Electric Company.

Mr. E. V. Sayles discussed the need for greater accuracy in Control Devices for Feeder Voltage Regulators, and urged that this matter be given more active consideration.

A special session was held during the evening of the first day for the consideration of tentative proposals prepared by a Subcommittee on Three Phase Pole-Type Transformer Standards.

A report based on conclusions reached in a study of Impulse Insulation Levels for Distribution Equipment was presented by Mr. H. F. Ostman, Union Electric Company of Missouri. Mr. R. C. Morris of the same company was a co-author of this report.

A moving picture prepared by the Kansas City Power & Light Company to demonstrate safety precautions to be taken when installing and operating shunt and series capacitors was shown by Mr. C. C. Cornelius. It was understood that this picture is available to others who may be interested in these practices. A prepared commentary accompanies it.

A detailed plan developed by the Boston Edison Company to aid in the restoration of service under severe emergency conditions was described by Mr. T. H. Haines. Mr. C. D. Brown, Wisconsin Electric Power Company, explained the Wisconsin Utilities Association emergency aid organization for coordinating information regarding assistance that would be available from all operating companies in that area in the event of a severe disaster or sleet storm.

A paper by Dr. R. J. Wiseman of the Okonite Company described "Factors Which Influence Aerial Cable Design and Operation." Mr. P. C. Waldron presented this report in Dr. Wiseman's absence.

A new photographic method of examining the structure of paper cable insulation and for recording cable overlays expeditiously and accurately was described in a paper by Mr. L. Meyerhoff, General Cable Company. Mr. Meyerhoff explained that this method has been found to be very useful in research work on high voltage cables and is a means of evaluating factory controls of tape overlays. The method has also been useful in recording wrinkles in the insulation and wax formation. It has also been used to some extent in studying cable failures.

Mr. H. E. Kent of Edison Electric Institute headquarters gave a brief summary of the work being done by the Joint Subcommittee on Rural Telephone Service by Carrier on Power Circuits.

A report on Impulse and Dielectric Strength Tests on Various Insulating Tapes was presented by Mr. G. B. McCabe of the Detroit Edison Company.

Mr. Andrew Bodicky, Union Electric Company of Missouri, announced that the Report on A-C Network Operations for 1941 and 1943 was in final form and is expected to be ready for publication shortly. Mr. Bodicky also presented a paper describing methods used by his company in the design of neutral capacity to serve both AC and DC networks which made it possible to remove much system DC neutral cable without adversely affecting operating conditions.

It was decided to cancel the regular May meeting of the committee. Plans for the next meeting will be announced later.

Accident Prevention Committee Meeting

H. O. Sprinkle, *Chairman*

THE Accident Prevention Committee of the Edison Electric Institute held its regular winter meeting at the Hotel Cleveland, Cleveland, Ohio, Feb. 8 and 9.

A preliminary report on the industry's 1944 accident experience was presented by Mr. E. J. Kreh. This report, based on a survey of the companies represented on the committee, showed a slight decrease in both frequency and severity rates over the previous year's experience. The summarized results of this survey showed:

	Sampling of 1944 Experience				*1943 Rates*	
	Employees	*Companies*	*Frequency*	*Severity*	*Frequency*	*Severity*
Electric Operations	53,530	21	10.02	1.16	11.73	2.07
Combination	24,256	22	10.29	2.01	12.18	2.74

A review of the industry's experience with resuscitation techniques by Mr. W. R. Smith showed that since 1933 the Institute received reports of 178 successful cases, which, but for the timely action of fellow employees, would undoubtedly have been added to the list of fatalities. Of the 178 near fatalities, 60 were traceable to the non-use of rubber gloves and eight of these involved potentials of 550 volts or less. Many successful cases of pole top resuscitation were also reported.

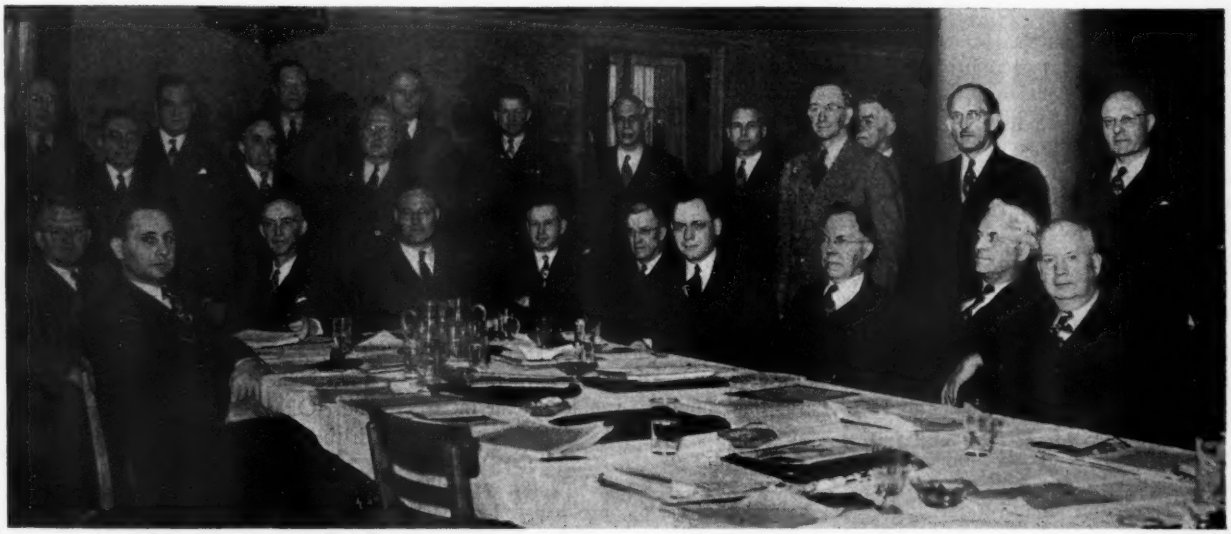
The third release in a series of Accident Information Exchange Bulletins was also submitted by Mr. Smith. These called attention to serious accidents and near accidents which have occurred in the industry.

Comments on the rubber situation submitted by Mr. T. R. Claffy, President of the W. H. Salisbury Company, Chicago, for the information of the members, indicated that stocks of crude rubber continue to be low and that manufacturers are being pressed to shift from natural to synthetic rubber "to the limits of technical feasibility." No further changes in crude rubber content for line hose, insulator hoods and blankets appear to be contemplated for the present. Gloves and sleeves are still being made entirely from natural rubber.

Mr. Claffy reassured the committee that present linemen's goods made during the emergency are safe and are rendering satisfactory service. He also stated that no one has suffered because of lack of availability. Utility companies, however, were urged to conserve their present stocks by all reasonable means and to caution regularly all linemen and others using rubber goods which contain synthetics, that these items require more careful handling to avoid snagging or lasting distortion.

Although several cases were reported where linemen were not satisfied with fabrics substituted for leather in safety belts and straps, one representative reported that his men find this equipment so satisfactory that it is doubtful they will go back to leather when it again becomes available.

Details of a survey made by Mr. D. C. Stewart on the question of personal hazards involved in the grounding of secondary A-C systems, indicated that



Some of the Key Men in Accident Prevention—EEI Accident Prevention Committee and Guests at Cleveland Meeting.

Seated, left to right—W. R. Smith, Public Service Electric & Gas Company; H. H. Berman, Consolidated Gas Electric Light & Power Co. of Baltimore; C. M. Mosher (Secretary), Edison Electric Institute; H. O. Sprinkle (Chairman), Monongahela West Penn Public Service Company; J. O. Leslie, Gilbert Associates, Inc.; J. B. Porcher, The Ohio Edison Company; D. C. Stewart, Niagara Hudson Power Corporation; G. S. Diehl, The Pennsylvania Water & Power Company; C. N. Rakestraw, The Cleveland Electric Illuminating Company; Ray Metzger, The Toledo Edison Company.

Standing—R. P. Douglas, The Detroit Edison Company; E. J. Kreh, Duquesne Light Company; H. N. McConnell, Ebasco International Corporation; H. P. Allen, Rockland Light & Power Company; E. C. Rue, Boston Edison Company; J. P. McCann, New England Power Service Company; D. T. Lacey, Central Illinois Public Service Company; E. L. Ide, The United Illuminating Company; W. T. Rogers, Ebasco Services, Inc.; E. M. Jasper, National Safety Council; E. E. Beck, Idaho Power Company; Alexander Maxwell, Edison Electric Institute; F. W. Frecker, The Ohio Power Company; H. J. Burton, Consumers Power Company.

the committee favored retaining present code provisions which permit selective treatment on individual cases and situations. The importance of good maintenance was emphasized, however, and also the desirability of making provision for the prompt detection of accidental grounds and their elimination as soon as possible.

The study of Low Voltage Employee Fatalities by Mr. D. C. Stewart, based on 252 electric shock and burn cases as reported by the industry in 1941, 1942 and 1943, showed that 19 of them involved less than 500 volts and might have been prevented if rubber gloves and rubber sleeves had been worn. In a number of other cases involving higher voltages, faulty grounding practices were considered to have been a factor, such as pulling in "dead" wires near energized wires, energized truck bodies and the like, where injuries might have been prevented if temporary protective grounds had been placed on the wires, truck bodies, etc., while they were in a position where contact might be made.

Plans were made to gather information on Lost Time Accidents by means of a brief questionnaire addressed to safety men throughout the industry. The results of this analysis will be summarized and made available to the industry as a guide to where efforts should be concentrated.

Mr. R. P. Douglas presented a report on the subject of returning service men and safety problems. The committee agreed that this question is largely for individual companies to work out and that there could be no one uniform policy for all. The regular safety program carried on for the benefit of present employees was considered an adequate training medium for the returning veteran.

Mr. H. H. Berman, Safety Director, Consolidated Gas Electric Light & Power Company of Baltimore, presented the second in a series of papers on How We Do It. Mr. Berman considered that cornerstones of his company's accident prevention program are Investigation, Inspection and Interest. Safety Investigations in this company are aimed at the prevention of accidents rather than at the fixing of responsibility. The main purpose of Safety Inspections is to provide an additional check on conditions and employee practices to see that safe conditions are maintained. Binding all together is active Interest and cooperation of all employees, including department heads and top management.

Further plans were made under the sponsorship of Mr. D. T. Lacey to cooperate with interested groups in the presentation of talks on subjects related to electrical safety.

Mr. W. T. Rogers presented attractively printed copies of the committee's study on Linemen Cutout Accidents. This report analyzes the causes of such accidents and suggests preventive measures that may be taken. Copies may be obtained from Edison Electric Institute Headquarters at 10c. each.

Similar Reports on "The Care and Use of Linemen's Rubber Protective Equipment" and on the "Care and Use of Pole Climbing Equipment" were reported by Mr. E. C. Rue to be in final draft form. He expects they will be ready for publication soon.

A preview of a new sound-slide film titled "Pole Top Pals" resulted in much favorable comment. This film was prepared under the direction of Mr. E. C. Rue of the Boston Edison Company in cooperation with the Liberty Mutual Insurance Company, and is the first of a series of such films to be sponsored by the Subcommittee on Visual Education under the Chairmanship of Mr. C. N. Rakestraw. After some minor improvements are made, copies of this film will be available to the industry at a nominal cost. An announcement in an early issue of the BULLETIN will tell those interested where and how they may obtain a copy of the film. Another film for which it is felt there is a real need is one dealing with the public and electrical hazards. This film would cover such things as fallen wires, kite flying in the vicinity of overhead lines, climbing poles or towers, and the use of cranes and derricks near overhead wires. The film would be shown before school groups, at Grange meetings, clubs, etc. It would point out the many benefits derived from the use of electricity but at the same time it would call attention to the hazards that should be avoided in the interest of public safety.

A feature of the second day of the meeting was a frank "off the record" discussion of various problems of special concern to safety men. This session was considered one of the highlights of the meeting. The discussion was led by Mr. G. S. Diehl.

It was reported that the Poster Committee Chairmen of the American Gas Association, Edison Electric Institute and the Public Utilities Section of the National Safety Council, are coordinating their efforts to produce posters to be distributed by the National Safety Council, based on actual needs of each industry as indicated by their accident studies. Some of these posters will be on general subjects covering the entire field, others will apply specifically to the Gas and Electric Industry to meet their respective accident prevention program needs.

Mr. W. T. Rogers, Publicity Chairman, reported on the extensive publicity given the committee's summaries. This information is regularly presented to the industry through reports and articles in the BULLETIN and other magazines. Direct constructive assistance in accident prevention is also provided by a series of monthly releases sent to safety directors in the industry. Many encouraging and appreciative acknowledgments were reported to have been received.

The next meeting is scheduled to be held at the Roosevelt Hotel in Pittsburgh on May 24 and 25, 1945.

Factors Which Influence

(*Continued from page* 81)

factory, shipped to the job and installed in one operation by placing rollers at each pole and pulling the cable through. Lengths of 1200 ft to 1500 ft can be easily pulled and it is not necessary to ride the messenger.

The copper binder tape has a lay of about 5 in. to 6 in. so it provides a very short distance for the drainage current to flow. As the cable is bound tightly to the messenger, there is no wearing of the insulation. In the case of a single conductor cable, if the messenger has the correct conductivity, such as obtainable with copperweld cable, then we have the best set-up for a single phase power circuit.

Fig. 3 shows the construction of an Okolite-Okoprene self-supporting cable with the in-built messenger.

The motion picture that I am going to show is an installation of a three-conductor, 2/0, 4150 volt aerial installation with the self-supporting feature. The cable was made at the time that Neoprene was critical so that we had to use a braid covering over the assembled conductors. We would have liked to use Okoprene over each conductor and no braid overall. The ease of installation as well as splicing and terminating is shown.

PERSONALS

The Board of Directors of New Jersey Power & Light Company has announced the election of WILLIAM F. MOSES as a Vice-President in charge of Customer and Employee Relations, RALPH N. MALEHORN as Comptroller, PAUL M. LENHART as Secretary and Assistant Treasurer and MRS. EUNICE G. ACKERMAN as Assistant Secretary. The appointment of NORMAN L. NELSON as Internal Auditor has also been recently announced.

Mr. Moses who has been Domestic Sales Manager for New Jersey Power & Light Company came to Dover from Cortland, New York, where he was District Manager for New York State Electric & Gas Corporation, an affiliated Company. Previous to 1944 he was employed in sales work for New York State Electric & Gas Corporation in Auburn, Geneva and Binghamton, his service with that organization beginning in 1915.

Mr. Malehorn began his business career in 1913 with York Haven (Pa.) Water & Power Company which was later purchased by Metropolitan Edison Company, an affiliate of New Jersey Power & Light Company. From 1923 to 1935 he was an accountant with headquarters at Reading, Pennsylvania. In 1935 Mr. Malehorn was transferred to New Jersey Power & Light Company where he has served as Accounting Officer and as Secretary and Assistant Treasurer.

Mr. Lenhart became associated with Metropolitan Edison Company in Reading in 1925 and was transferred to Dover, New Jersey, in 1935, serving in the Treasury Department of New Jersey Power & Light Company.

Mrs. Ackerman has been Secretary to the Vice-President and General Manager of New Jersey Power & Light Company from 1935 to 1943. In 1943 she became Secretary to the President.

Mr. Nelson was accountant for Staten Island Edison Corporation from 1924 to 1927 following which he joined a public utility service company as head of the audit review department. Since 1941 Mr. Nelson has been employed by NY PA NJ Utilities Company (parent Company of New Jersey Power & Light Company) as Report Specialist and Senior Accountant. Mr. Nelson joined the staff of New Jersey Power & Light Co. on January 1, 1945.

WALTER D. KLINE has been elected general counsel and also a member of the board of directors of Consumers Power Company.

In both capacities Mr. Kline succeeds CLYDE J. HOLMES, whose resignation because of ill health was accepted by the board of directors. Mr. Holmes, who has been associated with Consumers and predecessor companies for 38 years, had a major role in the development of the company, which now operates in 57 Michigan counties, supplying electric service to 500,000 customers and gas service to 225,000.

Mr. Kline has been with the Company's legal department since 1916. For the last several years he has held the title of general attorney. He was graduated from the University of Michigan in 1907 and engaged in private practice in Battle Creek for a number of years.

In 1914 Mr. Holmes moved to Jackson and became general counsel for the predecessors of Consumers Power Company. He assisted in the handling of legal work in connection with the organization of the present company in 1915. In 1929 he was elected a vice-president of Consumers. He has resigned this position along with those of general counsel and director.

W. R. WAY, formerly Assistant General Superintendent of the Operating Department, The Shawinigan Water and Power Company, has been promoted to the position of General Superintendent, filling the vacancy caused by the retirement of C. R. REID. ARTHUR S. GALL, formerly Superintendent of Distributing Stations, has been appointed Assistant General Superintendent of the Operating Department.

ELMER K. HIGLEY has resigned as General Auditor of Middle West Service Co. and has accepted the position of Controller of Public Service Co. of Oklahoma, Tulsa.

RODMAN MCCLANAHAN, Vice-President and Controller of United Public Utilities Corporation, Chicago, Illinois, formerly associated with Middle West Service Company, has been elected to succeed Mr. Higley as General Auditor of Middle West Service Co.

L. E. NASH, assistant to the General Auditor of Middle West Service Company, will continue in that capacity and, in addition, will act as Assistant to the Controller.

W. E. MITCHELL, vice-president and general manager, Georgia Power Co., Atlanta, has been appointed by the U. S. Chamber of Commerce to its Natural Resources Department committee for 1944-45.

CORNELIUS W. DEFOREST has retired as vice-president of the Columbia Engineering Corp., New York, and automatically from its affiliate the Cincinnati Gas & Electric Co.

A native New Yorker, Mr. DeForest obtained his early experience with the General Electric Co., Schenectady, and with the Brooklyn Edison Co. and the United Electric Light & Power Co., New York. He went to Covington, Ky., 42 years ago as chief engineer of the Cincinnati, Newport and Covington Street Railway Co. and of the Union Light, Heat & Power Co. in Covington and Newport when these companies became affiliated with the Union Gas & Electric Co., now the Cincinnati Gas & Electric Co., under Columbia Gas & Electric control. Mr. DeForest was brought to Union Gas as electrical engineer of both the Cincinnati and Kentucky companies subsequently to be made manager of the electrical department and later vice-president of the Union Gas & Electric Co. in charge of engineering and operation of the electrical department. In 1916-18 he supervised construction of the West End power station, as well as the new underground transmission and distribution system.

To meet the increased local demands, the Columbia Power Co. was organized in 1923 and Mr. DeForest was made vice-president, with the special assignment of selecting a site and supervising the design and construction of a new power station. The site at Columbia Park was chosen and the plant was placed in operation in 1926. The station, supplying Cincinnati and surrounding areas, has increased its capacity two and one-half times over its initial capacity. When the Columbia Engineering Corp. was organized he was put in charge of the electric division.

PRENTISS M. BROWN, chairman of the board, Detroit Edison Co., has been

made a member of the business advisory council of the U. S. Department of Commerce.

LEE C. WISE is now district agent in charge of electric and water systems recently acquired by the Pacific Gas & Electric Co. at Willits, Fort Bragg and adjacent areas in northern California, it was announced by the company which took over operation of the properties Jan. 1 from the California Public Service Co. Preparations to improve transmission facilities in the area and to link local lines with P. G. & E.'s interconnected system are underway. Mr. Wise, with the P. G. & E. since 1930, recently was commercial agent of the St. Helena and Calistoga area. The new properties are part of the company's North Bay division under the direction of Clifford Bartlett.

Announcement of the election by the board of directors of the Southern California Edison Co. of additional officers for the company, all from the present management organization have been made by Harry J. Bauer, president.

E. R. DAVIS, assistant general manager since 1932, was elected vice-president and assistant general manager. Mr. Davis is one of the foremost construction engineers in the electric utility industry and was one of the chief engineers of the Edison Big Creek-San Joaquin hydro electric development. His activity in the electrical industry of southern California dates from 1896 and he has been identified prominently with the advancement of technical phases of electrical engineering and operation.

N. B. HINSON, who also has been closely identified with the operating and engineering of the company for many years, was elected vice-president and executive engineer. Mr. Hinson is chairman of the Pacific Southwest Power Interchange Committee, which is one of the most important factors in the direction of generation and utilization of electric power for war industry in this area. He had held a number of executive engineering positions in the company with which he first became identified in 1906. He was appointed chief engineer and chairman of the company's engineering committee in 1934.

RALPH R. WALBRIDGE, commercial manager of the company since 1939, was elected vice-president and will have charge of business development activities of the company. He has had wide experience in Edison commercial affairs both in the company's district organization and as a management officer.

R. C. MCFADDEN, sales manager since 1939, has been appointed assistant vice-president to assist in the administration of commercial and new business activities of the company. Mr. McFadden has been associated with the company since 1916.

H. W. TICE was elected vice-president and will continue as manager of operation, the position he has held since 1941. Mr. Tice, who, before his affiliation with the Edison company in 1922, was identified with the electrical manufacturing and steel manufacturing industries, became operating engineer for the company in 1927 and assistant manager of operation in 1937.

R. G. KENYON, assistant vice-president since 1942 and formerly advertising manager, has been elected vice-president and will continue in charge of industrial relations for the company, the activity in which he has been engaged. Mr. Kenyon first was employed by the Edison company in 1917 and became advertising manager in 1932 after serving in the accounting, securities and employment departments.

GAIL C. LARKIN, a member of the Edison organization since 1922 and general counsel since 1942, was elected vice-president and general counsel. He will continue as directing head of the company's law department.

O. V. SHOWERS, assistant secretary of the company since 1917 and a member of the company's investment department was elected secretary to succeed the late Clifton Peters.

K. B. AYRES, superintendent of electric transmission and distribution for the San Diego Gas & Electric Co., has retired after completing 34 years of service. Starting in 1911, Mr. Ayres helped install the company's first underground electric distribution system in San Diego. As a superintendent of construction for San Diego's northern districts, he pioneered the surveys and original construction for electric systems in Escondido, San Marcos, Vista, and Rincon, as well as providing tie-ins between these areas and Oceanside. Promoted to superintendent over the company's entire electric distribution and transmission system in 1918, he managed the building of a greater part of San Diego's present system. During his 21 years of active membership in the Pacific Coast Electrical Association he held chairmanships on many important committees.

Changes in the executive personnel of New York State Electric & Gas Corp., Ithaca, have been announced.

WILLIAM G. HICKLING, vice-president in charge of operations, assumed additional duties as general manager and A. W. MILLIKEN, vice-president and manager of the company's eastern division, was made superintendent of operations. Under the change, Mr. Hickling continues as head of operating matters on a state-wide basis and in addition, the company's five division managers and the heads of safety and personnel report to him.

Mr. Hickling joined New York State Electric & Gas in 1941. He began his utility career in 1919 as engineer with the Penn Public Service Co., predecessor of the Pennsylvania Electric. In 1937, while continuing as vice-president of that company, he was moved to Erie, Pa., and was made president of the Erie Lighting Co., the position he held until he associated with NYSEG.

Mr. Milliken was associated with the New Bedford (Mass.) Gas & Edison Light Co. from 1922 until 1939, and advanced from a results engineer in the power plant to assistant and then manager of the electric department of the company and then to assistant general manager. He was made a vice-president and became manager of NYSEG's eastern division in 1939.

Two personnel changes in the supervisory force of the Columbus and Southern Ohio Electric Co., Columbus, Ohio, were announced recently when CHARLES Z. GILLIVAN was appointed general superintendent and EARL E. HARTSOCK was made assistant general superintendent.

Mr. Gillivan, who has been chief engineer since 1937, was called to fill the new position after 40 years of service with the company. As general superintendent Mr. Gillivan will continue to supervise the engineering and assume additional duties in supervision and the operation of company property.

Mr. Hartsock has been associated with the company since 1926 during which time he had filled various positions in the transportation and electric divisions. During the past two years he has acted in the capacity of system operator.

(*Continued on page* 88)

E.E.I. PUBLICATIONS AND SERVICE MATERIAL

(Prices include transportation in U. S. only. Please order by number shown before title. Standing Orders may be placed for a specified number of copies of reports of various committees as issued, to be shipped to one address.)

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Accounting and Statistical

Accounting	Members	Non-Members
Digest of Authoritative Opinions of the Definition of Original Cost (Including Appendix on "Prudent Investment") 1938	$1.50	$1.50
Proceedings—National Accounting Conferences		
Complete Set—8th Conference 1944	2.00	2.00
" " 7th " 1943	2.00	2.00
" " 5th " 1941	2.00	2.00
" " 4th " 1940	2.00	2.00
" " 3rd " 1939	2.00	2.00
" " 2nd " 1938	1.50	1.50
by Groups Yearly—		
Classification of Accounts	.50	.50
Customer's Relation	.50	.50
Depreciation	.50	.50
Plant Accounting and Records	.50	.50
Purchasing Stores & Transportation	.50	.50
General Sessions	.50	.50
Summary of Definitions Covering Depreciation and Related Terms 1939.	1.00	1.00
Statistical		
L-2—Electric Light and Power Industry in 1943 (1944)	.30	.75
K-2—Electric Light and Power Industry in 1942 (6/43)	.75	.75
J-2—Electric Light and Power Industry in 1941 (5/42)	.30	.75
I-2—Electric Light and Power Industry in 1940 (5/41)	.30	.75
(Statistical Bulletins also available for years 1932 to 1939 inclusive) each	.30	.75
Weekly, Monthly and Annual Statistics (Includes Annual Statistical Bulletin; Weekly Electric Power output; Monthly Electrical Research Statistics).	2.00	2.00

Engineering Committees

ACCIDENT PREVENTION—RESUSCITATION

L-4—Linemen Cutouts (2/45)	.10	
K-8—Pole Top Resuscitation (9/43)	.10	
(Quantity Prices on Application)		
J-9—1941 Accident Statistics of Electric Light & Power Industry (12/42)	.10	.25
F-10—Tree Trimming Practices (10/38)	.20	.50
E-12—Resuscitation Booklets (7/37) 1— 9 copies	.10 each	
10— 99 "	.08 "	
100—499 "	.06 "	
C-14—Resuscitation Charts (4/36)	.10	.10
C-12—Twelve Messages on Accident Prevention in the Electric Public Utilities (12/35)	.10	.10

ELECTRICAL EQUIPMENT COMMITTEE

J-8—Utilization Voltage Standardization Recommendations 1942	.20	.50
F-13—Reconditioning Flood Damaged Electrical Equipment (12/38)	.30	.75
F-5—Design of Switchhouses for Generating Stations and Transmission Substations (6/38)	.40	1.00
E-1—Rectifier Wave Shape (4/37)	.40	1.00
C-10—Symbols for Metering Diagrams (12/35)	.10	.10

HYDRAULIC POWER COMMITTEE

D-15—Penstocks (12/35)	1.00	2.50
A-19—Hydraulic Governors (8/33)	.20	.50

JOINT REPORTS

K-1—Volume 5 of Engineering Reports Nos. 39 to 49 of Joint Subcommittee on Development and Research (1/43)	5.00	10.00
J-8—Utilization Voltage Standardization Recommendations (10/42)	.20	.50
J-6—Wave Shape of Multi-Phase Rectifiers—Engr. Report No. 49—Joint Subcommittee on Development and Research (8/42)	.50	1.25
J-4—Low Frequency Shielding in Telephone Cables—Engineering Report No. 48—Joint Subcommittee on Development and Research (5/42)	.80	2.00
J-1—Positive Disconnection of Distribution Circuits During Faults to Ground—Engineering Report No. 47—Joint Subcommittee on Development and Research (4/42)	.60	1.50
I-9—Standards for Distribution Transformers (Second Report) EEI-NEMA (12/41)	$0.25	$0.60
I-8—Susceptiveness of Subscriber Station Sets—Engineering Report No. 46—Joint Subcommittee on Development and Research (12/41)	.60	1.50
I-7—Frequency Weighting for Message Circuit Noise — Engineering Report No. 45—Joint Subcommittee on Development and Research (12/41)	.20	.50
H-12—Neutralizing Transformers—Engineering Report No. 44—Joint Subcommittee on Development and Research (7/41)	.30	.75
H-10—Effects of Bonding Exchange Aerial Telephone Cable Sheaths to Multi-Grounded Power Neutrals—Engineering Report No. 43—Joint Subcommittee on Development and Research (6/41)	.30	.75
H-8—Standard Basic Impulse Insulation Levels — AIEE-EEI-NEMA (1/41)	.05	.05
H-3—Inductive Coordination Aspects of Petersen Coil Grounding—Engr. Report No. 42—Joint Subcommittee on Development and Research (12/40)	.25	.65
H-1—Test Specifications for Household Electric Ranges—EEI-NEMA (5/40)	.20	.50
G-9—Methods of Measuring Radio Noise—EEI-NEMA-RMA (2/40)	.20	.50
F-17—Short-Circuiting Relay Protectors—Engr. Report No. 41—Joint Subcommittee on Development and Research (8/38)	.40	1.00
F-8—Test Specifications Automatic Electric Storage Water Heaters—EEI-NEMA (10/38)	.20	.50
F-2—Inductive Coordination of Rural Power and Telephone Systems—Engr. Report No. 40—Joint Subcommittee on Development and Research (1/38)	.80	2.00
E-9—Characteristics of Power System No. 39—Joint Subcommittee on Development and Research (11/37)	.60	1.50
E-5—Principles and Practices for Inductive Coordination, EEI-AAR (1/37)	no charge	no charge
E-4—Joint Use of Poles 6.6 and 13.2 kv. Safety Features—EEI-Bell Tel. (1/37)	.30	.75
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"You Can Do Something About It"—(Home) sound slide, 15 minutes, 95 pictures	$10.00	" " "

PERSONALS

(*Continued from page* 86)

C. H. SPIEHLER, formerly associated with the Dayton Power & Light Co., Dayton, Ohio, but for the past 18 years connected with the Columbia Engineering Corp. with headquarters in Cincinnati, has rejoined the Dayton staff as a mechanical consulting engineer.

Promotions in the power production and transmission departments of Southwestern Gas & Electric Co. have been recently announced.

J. ROBERT WELSH, who has served the company for several years as superintendent of power, was promoted to the position of operating superintendent. Mr. Welsh joined the company in 1940, having formerly been employed as chief engineer by the L. E. Myers Co.

R. S. MONCRIEF, formerly chief engineer at the company's Arsenal Hill Station has been promoted to the new position of supervisor of power plants. He has been with Southwestern since 1925. Mr. Moncrief will be succeeded as chief engineer at Arsenal Hill by J. WEEMS TWILLEY, formerly station machinist, having been employed at the plant since 1926.

WILLIAM J. GOOGE, formerly relay engineer, has been promoted to the newly-created position of supervisor of transmission, in charge of all of the company's transmission lines from power stations to low tension terminals.

The fifth promotion announced by the company was that of PAUL GUNN, chief dispatcher, at the Arsenal Hill plant, who will serve as liaison agent between the departments of production and transmission, while continuing to perform load dispatching duties.

In announcing the promotions, F. M. Wilkes, president, stated they were made "both in recognition of outstanding work for the company in meeting wartime power production demands."

ROBERT B. MCCLURE, who has been a power engineer since 1926 with the Cincinnati Gas & Electric Co., has been appointed supervisor of the industrial development division of the company. He replaces CHESTER K. STERRETT, who recently took over an executive position with the Chamber of Commerce in Portland, Ore.

GEORGE A. ORROK, JR., has been appointed acting assistant superintendent of engineering, Boston Edison Co. CHESTER W. MCGILL becoming head of the electrical section, ELWOOD A. CHURCH head of the transmission and station planning division, and R. L. EWELL, assistant head of the mechanical division. All these appointments are in the engineering department.

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Rewiring for Commercial and Industrial Buildings	$0.25	$0.25
Handbook of Interior Wiring Design—1937	.50	.50
Basic Factors of Adequate Wiring—1939	.25	.25
Covered Neutral Cable Helps Sell Adequate Home Wiring—1939	.25	.25
Commercial Building Re-wiring Market—1939	.35	.35
(Price on above three books as a group is 60c per set)		
Films		
Commercial Re-Wiring — lantern slides	Set $17.50	
Home Wiring—lantern slides	Set 25.00	

Miscellaneous, Reference Books, etc.

Code for Electricity Meters (1941)	$1.60	$2.00
Good Radio Reception (1937)	100 copies	4.00
	1000 "	25.00
	3000 "	60.00
	5000 "	95.00
Objective Type Rates, 1933-1936	.80	2.00
Ice and Wind Loading Tables for Overhead Line Conductors (Revision of Tables 85 to 96 of the Overhead System Reference Book) 1942	1-4 copies	10
	5-49 "	6
Power Sales Manual, plus Sec. 12-13-14 of 1944 (1941)	4.75	7.00
Rate Book for 1943	10.00	25.00
Rewiring for Commercial and Industrial Buildings (1941)	.25	.35
Sales Training Manual—Commercial Electric Cooking (1941)	1.50	1.50
Storm Loading and Strength of Wood Pole Lines and a Study of Wind Gusts (1936)	2.00	5.00
Weekly, Monthly and Annual Statistics (Includes Annual Statistical Bulletin; Weekly Electric Power Output; Monthly Electrical Research Statistics)	2.00	2.50

Periodicals

Better Light—Better Sight News (9 issues yearly)	$0.75	$0.75
Edison Electric Institute Bulletin (Monthly)	2.00	2.00
Rural Electrification Bulletin (5 issues yearly)		1.00

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